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ABSTRACT

Presented are the results of a study to determine the perceived needs of environmental control education programs as seen by students, instructors, deans or program directors, and field-related employers in the field of water pollution control. Data were collected utilizing three approaches: survey instruments, information from Water Quality Instructors' Workshops, and on-site conference visitations to selected educational institutions. Perceived differences of the four groups to the needs of water pollution control training programs are detailed. Recommendations are included. (BT)

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WATER POLLUTION CONTROL TRAINING: THE EDUCATIONAL ROLE OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY

SE 030 293

WATER POLLUTION CONTROL TRAINING: THE EDUCATIONAL ROLE OF THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

A dissertation submitted to the
Division of Graduate Studies
of the University of Cincinnati
and the
National Training and Operational Technology Center for the
United States Environmental Protection Agency

in partial fulfillment of the
requirements for the degree of

DOCTOR OF EDUCATION

in the Department of Curriculum and Instruction
of the College of Education and Home Economics

1979

by

Frederick D. Williams

B.S. in Ed. Miami University, 1971
M. Ed. Miami University, 1975

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ABSTRACT OF THE DISSERTATION

WATER POLLUTION CONTROL TRAINING: THE EDUCATIONAL ROLE OF THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

by

Frederick D. Williams, Doctor of Education

University of Cincinnati, 1979

The major purpose of the study was to determine the perceived needs of effective and viable environmental control education programs, especially for instructional personnel. The major purpose addressed the need for properly educated instructors to train personnel, the development of refined education/training objectives, and accessible, quality, appropriate, update materials in water pollution control. Expansion of training in this field has been strongly supported by legislation mandating stricter environmental standards, yet such training programs vary greatly.

The survey involved assessment of the perceived needs of educational training among students, instructors, deans or program directors, and field-related employers in the field of water pollution control through analysis of collected data. Data was collected through utilization of three techniques. The techniques were survey instruments, "Water Quality Instructors' Workshop" information, and facts from on-site conference visitations to selected educational

institutions. Documentation required a search and review of information which exists in this field. In the process of assessing the perceived needs of the four named groups, questions using closed-ended form and Likert scale responses relating to curriculum content, teaching skills, format materials types, and attitude assessment involved 133 variables for the survey instrument. The return rate was 1,957 useable, returned surveys of 3,000 sent (67.1 percent). Data was collected at the workshops through supervised administration, completion and collection of surveys and evaluation comments. The on-site conference data was collected through use of audio-tape recordings that were compiled.

Tables were utilized to present data and to designate all the pertinent information directly related to the water pollution control training needs assessment and perceived needs for Agency involvement in the field. A four step analysis was applied to two survey areas (reliability scores, One Between, One Within Manovas and Scheffe Procedure for Analysis of Variance). Frequency tables to compile percentage scores were applied to the third area of the surveys, and The Purdue Master Attitude Scales' manual was followed for the fourth survey area. Data about the management of the workshop, information presented, and the participants' perspectives of the existing relationship between the Agency and educational institutions was recorded and reported, plus a summarized compilation of the questions and answers which were

exchanged in the on-site conferences.

In conclusion, the study indicated the highest priority of concern relates to the strengthening of water pollution control training institutions and their programs through activities which would narrow the perceived differences of the four affected populations relevant to this field. The study supported a definite need for more effective teaching methods information and training for instructors of water pollution control personnel. As evidenced by this study, accessability and cost factors have been limiting obstacles for educational institutions involved with water pollution control training. An indicated interest in Agency materials and programs among educational institutions was confirmed. The study demonstrated that most university's teacher education programs have made little effort preparing instructors in water pollution control training.

The following major recommendation was made relative to water pollution control training: A joint effort by members of the educational community and the USEPA-NTOTC in striving toward formation of an educational plan and model to be implemented through a national certification program incorporating additional needs assessment should be undertaken.

CHAPTER 1

FORMULATION AND DEFINITION OF THE PROBLEM

Introduction

The federal government and the general public are becoming increasingly aware of the impact of water pollution and other environmental problems on the nation. The Environmental Protection Agency is more closely scrutinizing municipal water and waste disposal stations as well as chemical and other industrial plants. (USEPA, 1973c) Federal inspections have been increasing in frequency. Furthermore, the Congress has been passing legislation mandating stricter environmental standards. (U.S. Congress, H. R. Committee on Public Works, 1973c) As a result of this there has been an increased demand for municipal and industrial personnel trained in environmental monitoring, especially in the field of water pollution control. (Ware, 1974, p.86-88) Fortunately, enrollment in training programs relating to this area has increased. (USEPA, 1974f)

If such a demand for these programs exists, then it is incumbent upon the Environmental Protection Agency to design programs to educate the instructors who will teach the kind of program noted above. Their participation in conjunction with educational institutions is necessary to overcome costs and time limitations, which exist within educational institutions. The joint action of the Agency with educational institutions can further overcome the specific problem of matching training curricula to field needs. Additionally, the Agency can provide incentive for incorporating update and new materials into curricula, or even simply making knowledge of these materials known! That is, EPA needs to educate personnel on how to train future workers in the field of water pollution control. (USEPA, 1972e, sections IV-VII) Some instructors are currently being educated through practical work experiences, classroom experiences, orientation workshops held by individual colleges and universities, and EPA-sponsored workshops, classes and seminars, all conducted on a variable basis. (Wenner, 1974, p. 51-293)

Statement of the Problem

Environmental control training in the United States is a broad term covering many diverse fields. (Morris, 1969, P. 290, 438, 1320) Even consideration of a specific field

like water pollution control is divided among many service areas. (Morris, 1969, p.290, 1015) Further within this framework, there are varying kinds of training programs throughout this country for future workers in the field of water pollution control: graduate education, four-year degree programs, two year associate degree programs, community college courses, state training institutions, and vocational-technology training. (USEPA, 1972k) Yet, lacking a comprehensive program as a model, the environmental control systems of the United States in many ways are only partially meeting their delegated responsibilities. (USEPA 1972c, sections V, VI, VII) For example, billions of federal dollars have been spent to build treatment facilities and buy sophisticated equipment for treating sewerage, but these facilities have been operated at far less than ideal efficiency because of a lack of properly trained operators. (National Water Commission, 1973)

An important part of the burden of improving this situation is the responsibility of the water pollutuion control instructor in whatever type institution he or she serves. The problem involves analysis of existing educational opportunities for these instructors plus recommendation for any logical deletions, changes, revisions, or additions to programs with regard to curriculum, the methodology, and program format. This is an important first step toward

unification of a formal and official program to prepare individuals in teaching techniques dealing with environmental monitoring or control.

Purpose of the Study

The purpose of this study is to determine the needs of effective and viable environmental control education program for instructional personnel, and what the role of the USEPA, as the official Federal government agency dealing with the environment, ought to have in such training. Two levels of environmental work force are expected to be surveyed as a part of this study. First, this study will assess the perceived needs of instructors, program initiators, and implementors of courses in water pollution control who would directly benefit from such a program development; and secondly, this study will assess the perceived needs of operational personnel (students, employers) in programs established by such instructors or institutions, who ought to receive only the finest training and available information. (Middlebrooks, 1972b)

The major purpose of this study will be addressed to the need for:

(1) properly educated instructors to train personnel

(2) the development of refined education/training objectives (USEPA, 1972e, section III)

(3) accessible, quality, appropriate, updated

materials in water pollution control (USEPA, 1977p) Additionally, the process and contacts of this study are expected to encourage the introduction or revision of course offerings and training programs in water pollution control at institutions across the country to ultimately enable individual states to be self-sufficient in the field of water pollution control.

The massive problem of communication, dissemination, and implementation of information and materials among the groups directly considered in this study was an overarching question that required contemplation, data collection, analysis, and recommendation toward improvement and resolution of the situation. Within this study, questions arose regarding the determination of the perceived needs among the four categories of people noted in the limitations section of this study. Another top priority question area in this study was the degree to which the NTCTC of the USEPA should exert its influence in the field of water pollution control training. Some specific questions from this last area of concern included the following:

(1) Should the USEPA help educators run training programs?

(2) Should the USEPA provide curriculum materials and in what form?

(3) What should be the nature of instructional

assistance provided by the USEPA?

(4) How much financing responsibility should be assumed by the Agency and government?

(5) Are there areas of present Agency training programs that should be deleted or revised?

In answering these questions and others like them, the degree and possible function of Agency participation is espected to emerge.

Rationale

The need across the country that exists for technicians operators and engineers who are trained in the area of water pollution control has been identified. (Middlebrooks, 1975a Middlebrooks, 1975c; Middlebrooks 1972d; Middlebrooks, 1974e Middlebrooks, 1977f) As new water pollution control guidelines are put into effect, a great increase in the number of facilities and systems is expected. (USEPA 1973) A corollary increase in the demand for properly trained personnel for these situations places greater importance on the instructors of usch personnel thatn has ever been previously expected or required - in terms of both quality performance and quality of staff. (USEPA 1974f)

Various educational institutions and the USEPA are already involved in the development and production of materials and resources to equip instructors to provide instruction and experience which will enable individuals to design, operate, manage, and monitor both new and

extant water pollution control facilities and systems. (USEPA 1977B, p.13; USEPA 1977, p,p 20-21) As previously mentioned, these programs have been highly specialized and generally limited in availability and use. (USEPA 1972e, section VI)

In order for such training to satisfactorily be accessible and serve the continually expanding and diverging population, it will be necessary to provide water pollution control training centers and educational institutions (universities, colleges, community colleges, state training institutions, vocational training schools) with a model or official program incorporating quality standards that warrant nationwide dispersal. The general aim of such a program would be to provide for and facilitate the implementation of training programs and resouces which are required for the specialized training of water pollution control personnel. Though such leadership might come from either commercial areas or governmental agencies, it is expected that the initial leadership would most likely be provided by the Office of Education, since they have the primary responsibility for education on the Federal level, specifically designating the United States Environmental Protection Agency. (USEPA, 1977g) A secondary aim of such a program could well include acquainting a larger portion of the educational community with the need that exists for water pollution control personnel. (Unger, 1973)

Overall, the design and implementation of such a program needs to occur in conjunction with needs assessment to be certain that the most efficient and effective program possible is established and maintained. (USEPA, 1972e, section VI) The ultimate aim of such a program, provided with the direction and required continued action by the USEPA in water pollution control training, would be that the individual states of this country will become self-sufficient in water pollution control training efforts.

Definition of Terms

Certain terms are incorporated throughout the study. To facilitate unambiguous meaning of the material, it is important to identify and define some of the terminology.

Agency As used in this study it refers to the United States Environmental Protection Agency as the service authorized by the Federal government to act in certain areas for the government and the people.

aims A term used in place of the combination goals and objectives which is intended to be synonomous to their joint definitions.

attitude This is a word used to refer to a general tendency of an individual or category of individuals to act in a certain way under certain conditions. It is generally based on visible behavior or statements when used in this study. (Mager, 1968, p.14)

classes A term used interchangeably in this study with workshops, or formal education in a specialized field.

curriculum In this study the term is used to refer to the printed descriptions and materials for particular courses of study regardless of degree of difficulty or length in the specialized field of concern for this study. (Morris, 1969, p.324)

education, educate A noun and verb used to mean comprehensive learning achieved either by experience or more often by formal instruction. (Morris, 1969, p.1320)

educational institution An organization dedicated to public service which serves to impart knowledge or skill; includes colleges, universities, community colleges and vocational or technical training locations for this study. (Morris, 1969, p.415 & 680)

environmental control The act of holding in restraint or checking through exercise of authority or dominating influence over the complex of social, cultural, and physical conditions affecting the nature of individuals and communities. (Morris, 1969, p.290 & 438)

facilities The physical plant and other mechanical equipment used in the areas and field under consideration in this study.

goal The purpose toward which an endeavor is directed, but not always based on observable phenomena, and generally groups several objectives. (Mehrens, 1973, p.18)

government A term used in this study to designate the central government of the United States unless some other governing body is specified by adjective, such as, state government. (Morris, 1969, p.570)

instruct A term which usually suggests methodical direction or teaching in a specific subject or area; often used synonomously in this study with teach. (Morris, 1969, p.320)

instructional objective This is an objective that will identify what a student would be doing when demonstrating achievement of the objective as well as suggesting conditions relevant to the desired performance, and suggests how to tell when the objective has been achieved. It is also a term that helps clarify direction of progress and describes how to know when it has been attained. (Mager, 1968, p.61)

instructor One who gives instruction to personnel in the field of water pollution control imparting knowledge or skill to others; synonomous in this study with teacher, or trainer. (Morris, 1969, p.320 & 681)

National Training Operational Technology Center (NTOTC) A branch of the USEPA involved with workforce training for environmental quality, located in Cincinnati, Ohio.

operators Those who work in the field.

personnel Those who monitor water pollution programs, synonymous with operators.

(P.L. 80-845) "The Reorganization Act of 1946" the land-

mark legislation in the field of water pollution control. The measure contained a five-fold purpose, covering a three year period.

(P.L. 82-579) Extended P.L. 80-845 through 1956. (U. S. Library of Congress, 1973 a, Vol.I, p.754)

(P.L. 84-660) in 1965 established a permanent program for national water pollution control, and established a permanent, national water pollution control program. (U. S. Library of Congress, 1973 a, Vol.I, p.754)

(P.L. 87-88) mainly provided a program administrating responsibility switch. (U.S. Library of Congress, 1973a, Vol I, p.754)

(P.L. 89-234) "The Water Quality Act of 1965" required states to establish water quality standards, implementation and enforcement plans for approval by the proper Federal authority by mid-1967 and increased financial allowances providing research and development grants for better methods of controlling pollution. (U.S. Library of Congress, 1973a, Vol. I, p.755)

(P.L. 89-753) "The Clean Water Restoration Act of 1966" provided continuation and increase in amounts available for sewage treatment constructions during the years 1967-1971. (U. S. Library of Congress, 1973a, Vol. I, p.755)

(P.L. 91-190) "The National Environmental Policy Act of 1969" was a measure which established the Council of Environmental Quality and mandated establishment of a

national policy for the environment. (Council on Environmental Quality, 1970, p.243)

(P.L.91-224) "The Water Quality Act of 1970" established Office of Environmental Quality as staff support for the Council of Environmental Quality. (U.S. Library of Congress 1973a, Vol.I, p.755)

(P.L. 92-500) "The Federal Water Pollution Control Act Amendments of 1972" The most significant Federal measure in regard to this study, is a major legislative revision of the then existing water pollution laws. It is an act designed to effectively control water pollution in order to preserve environmental quality, maintain general public health, recreational resources, and the quality of public life. (U.S. Library of Congress, 1973a, p.3)

(P.L. 92-532) "The Marine Protection, Research, and Sanctuaries Act of 1972" provided for regulation of the dumping of industrial and municipal wastes at sea. It also requires regulations of the disposal of radioactive waste in the ocean by the USEPA.(92nd Congress, H.R. 9727, 1972, p.1)

(P.L. 93-254) "The Marine Protection, Research, and Sanctuaries Act of 1972, amendments" was enacted to implement the provisions of the Convention on the Prevention of Marine Pollution by dumping of wastes and other matter, and for other stated purposes. (93rd Congress, H.R. 5450, 1974,p.1)

(P.L. 93-523) The Safe Drinking Water Act of 1976" established national regulations to protect public health. (USEPA

1977g, p.13)

P.L. 94-62 "Marine Protection, Research, and Sanctuaries Act of 1972, amendment." to authorize appropriations to carry out the provisions of such Act for fiscal year 1976 and for the transition period following such fiscal year and for other (stated) purposes. (94th Congress, H.R. 5710, 1975, p.1)

P.L. 94-326 "The Marine Protection, Research, and Sanctuaries Act of 1972" Extension, extended P.L. 92-532 for two years.(94th Congress, S.3147, 1976, p.1)

P.L. 94-469 "The Toxic Substance Control Act of 1976" applied to chemicals that may enter the environment and ruin the water or air. It calls for regulation of the production and use of all chemicals harmful to public health or the environment. This measure banned PCB's from manufacture in 1979. (Office of the Federal Register, National Archives and Records Service, 1976, p.2003)

P.L. 95-217 "The Clean Water Act of 1977" commonly referred to as the Clean Water Act, amended P.L. 92-500 to provide for additional authorizations, and for other stated purposes.(U. S. Library of Congress, 1978c, VolIII, p.4)

pollution The contamination of the atmosphere, water, or soil by the discharge of noxious substances. (Morris, 1969, p.1015)

program A set procedure for solving a problem that includes collection of data, processing, and presentation of results;

as used in this study more encompassing than process or procedure. (Morris, 1969, p.1045)

<u>resource</u> Something that can be turned to for support or help, involving means that can be used to an advantage. (Morris, 1969, p.1170)

<u>seminar</u> A meeting or series of meetings for an exchange of ideas in some special area often involving original research in this study sometimes used interchangeably with conference and workshop, but without implying the direct physical involvement of most workshops.

<u>train, training</u> A term that implies concentration on a particular skill or set of skills intended to prepare an individual for a certain role as used in this study. (Morris 1969, p.1015)

<u>United States Environmental Protection Agency (USEPA)</u> A unit of the Federal government established to unify the efforts of related centers and more clearly define lines of authority in actions of the subdivisions of this unit. (USEPA, 1977g, p.3)

<u>water pollution</u> Any contamination of water by the discharge of noxious substance either man-caused or naturally occuring (Morris, 1969, p.1015)

<u>water pollution control</u> The act, process, or routine to make proficient with specialized instruction and practice to enable individuals to exercise expertness to control water pollution. (Morris, 1969, p.290 and 1015)

workforce All workers available to a nation or project; or those employed in a specific project - a staff. Previously termed manpower. (Morris, 1969, p.1475)

workforce training The training of people for special jobs and tasks in described fields expected to experience increasing numbers of positions for gainful employment. Previously synonomous with manpower training. (Morris, 1969, p.1014 and 1475)

Delimitations of the Study

This study is intended to document the history and bacgrcund of selected aspects of the field of water pollution control; education and training. Through this documentation, relationships among educational institution program directors, instructors, students, personnel who employ for firms in this field, and the Agency is clarified. The major focus was an assessment of perceived educational training needs for assistance, resources, content areas, and teaching skills in this field. A final aspect of this study problem is to suggest the possible proper Agency role in view of the current status and needs as they are determined and analyzed.

Limitations of the Study

Documentation, establishment of relationships, assessing perceived need and provision of a synthesis have been

identified as demarcating the limits of this study. Defining these identified restrictions for the study is intended to provide better understanding of the limitations of this study.

Documentation required a search and review of information and materials which presently exist in this field, especially that which related to aspects of educational training or other workforce needs. Relationships among four categories of individuals was investigated to ascertain common perceived needs. These four categories include directors of programs at educational institutions, instructors, students, and persons that hire for commercial and governmental bodies involved in the field. Assessment of the needs among such groups was basically the main thrust of the study. In the process of assessing these perceived needs and providing a synthesis or summary and conclusions to the study, a second focus was expected to be achieved. The second focus was to establish as clearly as possible the proper role the United States Environmental Protection Agency, especially its National Training Operational Technology Center, in working conjunction with the above named groups.

Assumptions

Related to this study and USEPA activities are several assumptions. One assumption was that the instructional

technology that exists can and will be upgraded. It was further assumed that new training resources and delivery systems in water pollution control and water pollution control training will probably evolve as a direct or indirect result of this study. Educational institutions are expected to incorporate water pollution control training and education into their curricula. A major assumption was that individual states in this country will become self-sufficient in the area of water pollution control as a long nange, future result. In drawing recommendations and conclusions regarding the assessment of perceived needs of the previously mentioned groups involved with water pollution control training, the degree and possible function of Agency participation is assumed to emerge.

Overview of Method: and Procedures

Data was collected for two purposes: to asses the perceived needs of students (future operators), instructors, program idrectors and employers; and to possibly modify the format and basic nature of Agency training programs and resources to be even more functional in an educational institution setting. The data was in the form of questionnaire and survey teype assessments of individuals from these groups regarding their perceptions of training programs and training resources. Information was collected through the use of questionnaires, surveys, and a series of inter-

views at institutions not only with instructors, but also with affected deans-program directors, and students during a limited number of visits to selected educational institutions across the country. Summary information was taken from data collected at 3 water quality instructors' workshops presented at the USEPA in Cincinnati by the University of Cincinnati College of Education and Home Economics staff. Similar contacts were established with firms who hire in this field, either by direct contact or a survey instrument. Individuals were evaluated, as a part of these groups, to determine the depth of their acquired understanding about the nature of the perceived workforce need, the training required, and the Agency resources available. The main attention and emphasis was directed to the perceived need of these groups, especially those held in common.

Organization Of The Study

Chapter one of this study includes the introduction, statement of the problem, purpose of the study, rationale, definition of terms, delimitations of the study, limitations of the study, assumptions and questions, an overview of methods and procedures, and the organization of the study.

Chapter two contains a review of related literature that pertains to educational training in the field of water pollution control. This includes the functions of

program directors of educational institutions, instructors, students, persons who hire for firms in the field, and the Federal government as represented by the USEPA, especially the NTOTC. Some history of these bodies and legislation which has influenced the field of water pollution control, water pollution control training.

Chapter three presents a description of the setting and procedures. This is followed by a description of the instruments, sources of data, methods of gathering data, plus description of the developmental phase, and staffing. A summary is included.

Chapter four contains a presentation of information gathered, surveys completed, an analysis of the data, listing of assessed perceived needs and other findings of the investigation and research involved in the study.

Chapter five is reserved for discussion, conclusions, recommendations, and a summary of the actual dissertation. Comments on areas for further study are also included here.

CHAPTER TWO

REVIEW OF THE RELATED LITERATURE

Background and History

Legislative History

Early stop-gap legislation focusing on control of water pollution includes The Refuse Act of 1899, the Public Health Service Act of 1912, the Oil Pollution Act of 1924, and the Reorganization Act of 1946. The serious national need for water pollution control has only been recognized as a significant problem during the last thirty years (1948-1978), beginning with P.L. 80-845, which has been considered to be the landmark legislation in this field. (U. S. Library of Congress, 1973a, Vol. I, p.753)

In the period of the late 1950's through 1960's and with expanding awareness and action in the 1970's, environmental affairs have become serious public concerns. From the time of the establishment of the permanent, national water pollution control program created through P.L. 84-660, the urgency of conservation and control have been reversing

the dominance that expedient economics and waste of plentiful resources for financial gain had previously held.

There are several major reasons upon which the government based the establishment of policies and legislation in environmental matters. It was noted that metropolitan and urban areas with their swelling percentages of the nation's population often exceeded local boundary lines and even extended themselves across state lines. It was further recorded that such urbanization, and the resultant, increasingly complex pollution problems was endangering the public health and welfare. This endangerment awareness through efforts of The Public Works Committee began to highlight the need for an active and accelerated water pollution control program which was enacted through P.L. 87-88.(U. S. Library of Congress, 1973a, Vol. I, p.754)

Although prevention and control of such pollution was noted as the primary responsibility of state and local governments, it was further recorded that Federal financial assistance and leadership were essentially required for the development of cooperative Federal, state, regional and local programs to prevent and control such pollution.

The pollution of the waterways and water pollution control is a main field in these environmental matters. Though such water pollution and water pollution control have at times received legislative attention, the measures

have only partially achieved their purposes. This reflects complications from insufficient funding, public indifference and the fact that water is more complicated to clean since it ends up with pollution from all forms (i.e. air pollution solid waste disposal, radiation and pesticides). Water pollution control has been further impaired by many reorganizations, transfers, restructurings plus start-stop arrangements and workforce shortages of authorized bodies of the government dealing with water pollution control programs. The inability of such authorized bodies to function and deal responsibly with legislated act requirements is partially reflected in this list of power alterations and changes. (U. S. Library of Congress, 1978a, Vol.1, p.765)

1948 - Division of Water pollution Control established in the Department of Health, Education and Welfare. Shortly thereafter, the division was transferred to the Bureau of State Services of the Public Health Service.

1954 - Division of Water Pollution Control was reduced to a branch and was consolidated with other divisions into the new Division of Sanitary Engineering Services.

1959 - Water Pollution Control Branch and other water pollution research and technical functions became the Division of Water Supply and Pollution Control.

1960 - Division of Water Supply and Pollution Control was grouped with other divisions to form the environmental health segment of the Bureau of State Services, Public Health Service.

1961 - Research and training grant responsibilities under the control of the National Institutes of Health were transferred to the Division of Water Supply and Pollution Control.

1965 - Division of Water Supply and Pollution Control became the Federal Water Pollution Control Administration, a separate administration within the Department of Health, Education, and Welfare.

1966 - Federal Water Pollution Control Administration was transferred to the Department of the Interior in accordance with Reorganization Plan No. 2.

1967 - Federal Water Pollution Control Administration was reorganized.

1968 - Federal Water Pollution Control Administration was reorganized.

1970 - Federal Water Pollution Control Administration became the Federal Water Quality Administration.

1970 - Federal Water Quality Administration was transferred to the Environmental Protection Agency in accordance with Reorganization Plan No. 3, and became the Water Quality Office.

1971 - Water Quality Office became the Office of Water Programs and with the Office of Air Programs was placed under the Assistant Administrator for Media Programs. (U. S. Library of Congress, 1973a, Vol.I, p. 765)

The serious national need for water pollution control has only been recognized as a significant problem during the last thirty years (1948-1978), beginning with P.L.80-845, which has been considered to be the landmark legislation in this field. (U.S. Library of Congress, 1973a, Vol. I,p.753)

Passage of this measure is mainly credited to the Committee on Public Works that was established in 1946. The measure contained a five-fold purpose, covering a three year period, which provided: the Surgeon General authority to assist and encourage interstate compacts, State studies and plans, and uniform State laws for pollution control; research support; Department of Justice authorization with State consent to bring suits to eliminate practice leading to pollution by individuals or firms following notice and hearings; establishment of the Federal Water Pollution Control Advisory Board; as well as providing funding authority covering low interest-limited loans to construct sewage and waste treatment works, grants for State pollution studies, and grants for construction plan drafting of water pollution control projects. It was extended through 1956 by P.L. 82-579, and in 1956 P.L. 84-660 established a permanent program for national water pollution control. This measure provided more comprehensive Federal participation through increased, intensified and broadened technical assistance, research, and financial grants, along with modified enforcement powers to control interstate water pollution. (U. S. Library of Congress, 1973a, Vol. I, p.754)

Five years later, in 1961, with increasing public awareness and less than successful attainment of enacted purposes and goals, the need for a more active and viable

water pollution program resulted in passage of P.L. 87-88. This measure mainly provided: a program administration responsibility switch from the Surgeon General to the Secretary of Health, Education and Welfare; larger building grants through 1967; establishment of "... seven regional laboratories for research and demonstration in improved methods of sewage treatment and control." (U.S. Library of Congress, 1973a, Vol. I, p.754); elimination of the need for State permission in interstate water pollution suits and extended enforcement to eliminate water pollution in navigable intrastate and coastal waters with the owner's permission only. (U. S. Library of Congress, 1973a, Vol. I, p.754)

Following enactment of two additional measures, (P.L. 89-234), the "Water Quality Act of 1965" and (P.L. 89-753), the "Clean Water Restoration Act of 1966", the present structure of the water pollution control program was provided. The two main provisions of the "Water Quality Act of 1965" were: requiring States to establish water quality standards, implementation and enforcement plans for approval by the proper Federal authority by mid-1967; and increased financial allowances--providing research and development grants for better methods of "...controlling pollution from stormwater and combined sewer overflows and for increased amounts for constructing sewage treatment works" (U. S.

Library of Congress, 1973a, Vol. I, p.755) during 1966 and 1967. Continuation and increase in amounts available for sewage treatment constructions were provided for the years 1967-1971 by the "Clean Water Restoration Act of 1966". However, both of these measures have been denied full achievement for different reasons. The first was impaired by shifting and reorganization of the designated proper Federal authority. This shifting of authority ranged from the 1965 Federal Water Pollution Control Administration in the Deptartment of Health, Education and Welfare being transferred by Reorganization Plan No.2 to the Department of the Interior in 1966, then reorganized in 1967,and again reorganized in 1968, followed by a change to the Federal Water Quality Administration in 1970, just prior to Reorganization Plan No. 3 which transferred the new Federal Water Quality Administration of the USEPA where it became the Water Quality Office, and 1971 changed again to become the Office of Water Programs under the Assistant Administrator of the USEPA who was delegated proper Federal Authority from the Administrator of the USEPA as named in various parts of legislation to be responsible for carrying out the enacted laws of the water pollution control program (previous to 1965 it had been the Division of Water Supply and Pollution Control). Appropriations of expenditures set in the latter measure (the "Clean Water Restoration Act of 1966") have barely

exceeded 50 per cent of the designated total. (U. S. Library of Congress 1973a, Vol. I, p.755)

The "National Environmental Policy Act of 1969" was a measure which established the Council of Environmental Quality and mandated establishment of a national policy for the environment as the two major purposes of P. L. 91-190. Two additional purposes were "...to enrich understanding of ecological systems important to the Nation and to promote efforts which will prevent or eliminate damage to the environment, biosphere and stimulate the health and welfare of man." (Council on Environmental Quality 1970, p.243)

The next year, (P. L. 91-224) the "Water Quality Act of 1970" set forth,

> ...major innovations in the law concerning oil pollution from vessels and on-shore and off-shore facilities, Federal permits and licenses, sewage pollution from vessels and hazardous substances discharged into the waters of the United States.

(U. S. Library of Congress, 1973a, Vol. I, p.755) It was this measure which established the office of Environmental Quality as staff support for the Council of Environmental Quality that experienced work force shortages following its inception the previous year.

The "Federal Water Pollution Control Act Amendments of 1972" (P. L. 92-500) set two major national goals to finally achieve the objective, "...to restore and maintain the chem-

ical, physical, and biological integrity of the Nation's waters." (U. S. Library of Congress, 1973a, Vol. I, p.3, 71, and 76) The two national goals declared were

> (1)...to eliminate the discharge of pollutants into the waters of the United States by 1985 and (2) to achieve water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water to be achieved by 1981. U. S. Library of Congress, 1973a, Vol. I, p.3, 71, and 77)

Achievement of the objective and stated goals were prescribed by thirty-four provisions detailed in this measure that generally specified action along six policy points. The policy points are identified and can be listed as follows: (1) to prohibit the discharge of toxic pollutants in toxic amounts, (2) to provide financial assistance to communities to construct publicly owned waste treatment facilities, (3) to increase research and development, (4) to expand the regional and basin planning and management programs, (5) to eliminate red tape in the administration of water pollution control programs, and (6) to encourage Federal-State efforts in the water pollution control policy. (U.S. Library of Congress,1973a, Vol. I, p.759) This amending measure replaced twenty-seven sections of the previous measure with five titles each containing more specific sections within the second section of the thirteen major sections clearly printed as the format of this measure.

(U. S. Library of Congress, 1973a, Vol. I, p. 759) The Federal Water Pollution Control Amendments of 1972", also required establishment of effluent and water quality limits for radiation discharges. (USEPA, 1977g, p.22) During that same year, P. L. 92-532, the "Marine Protection, Research, and Sanctuaries Act of 1972" was also enacted. This measure provided for regulation of the dumping of industrial and municipal wastes at sea. (92nd Congress, H.R. 9727, 1972, p.1) It further required regulations of the disposal of radioactive waste in the ocean by the Agency. (USEPA, 1977q, p.22)

More recently, P. L. 93-523, the "Safe Drinking Water Act of 1976" established regulations to protect public health, especially with respect to the fact that there are 4,000 known cases of waterborne illnesses each year across the country. The measure obligated water suppliers to notify the public when the quality of their product fails to meet Federal regulations. The Agency was additionally authorized by this law to supply grants for demonstration projects concerning either better treatment technology or methods for assuring a safe and dependable water supply, and to provide technical assistance to the States. Establishment of radiation criteria by the Agency was based on portions of this measure as well. (USEPA, 1977g, p.13) The USEPA received further expanded responsibilities and authority

in pollution matters with the passage of the "Toxic Substance Control Act of 1976" (P.L. 94-969). The measure applied to chemicals that may enter the environment and ruin the water or air. It called for regulation of the production and use of all chemicals harmful to public health or the environment.(Office of the Federal Register National Archives and Records Service, 1976, p.2003) Under this measure, PCB's will be banned from manufacture in 1979 by Federal court order while vinyl-chlorides and spray can propellants are receiving increased testing on toxicity and environmental effects. (USEPA, 1977g, p.22) An amending measure, P. L. 93-254, was enacted in 1974. This act was enacted,"...to implement the provisions of the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, and for other purposes." (93rd Congress, H.R. 5450, 1974, p.1) The next year an additional amendment, P. L. 94-62, was enacted. This act provided authority expenditures and financing through the transition period following fiscal year 1976. (94th Congress, H. R. 5710, 1975, p.1) The authority and provisions of P. L. 92-532 were further acted upon to extend the act (P. L. 92-532) an additional two years by P. L. 94-326, " The Marine Protection, Research, and Sanctuaries Act of 1972, extension." (94th Congress, S. 3147, 1976, p.1)

The most recent publications of the United States

Library of Congress, Environment and National Resources Policy Division of the Congressional Research Service includes Implementation of the Federal Water Pollution Control Act, and A Legislative History of the Clean Water Act of 1977, A Continuation of the Legislative History of the Federal Water Pollution Control Act, Vols. III and IV (1977b, 1978d, 1978e). The amending of P. L. 92-500, by P. L. 95-217 the "Federal Water Pollution Control Act, is commonly referred to as "The Clean Water Act of 1977." (U. S. Library of Congress 1978d, Vol. III, p.4, 179, 185) The act was mainly to provide for additional authorizations, though many other changes, both deletions and additions, were enacted. These changes were detailed in a report titled, The Clean Water Act Showing Changes Made by the 1977 Amendments. (U. S. Library of Congress, 1978d, Vol.III, p. 51-179) The act was extended to make some corrections to the national water pollution control program to reaffirm a national committment to protect the quality of waters and the health of citizens in this country. Long term funding for a municipal sewage treatment construction grant program is expected to help states and local governments to plan and begin programs to avert municipal pollution. The importance of controlling toxic pollutants was also emphasized along with amendments to oil and hazardous spill provisions. There are some additional stated purposes

in the act, all of which the President of the United States retains authority "to grant exemptions to prevent unnecessary delays in implementing the important energy program." (U. S. Library of Congress, 1978d, Vol. III, p.182) Further amending actions may be enacted during 1979 to achieve higher worldwide pollution standards and to protect the marine environment in the oceans. (U. S. Library of Congress, 1978d, Vol. III, p.181-182)

The problem of controlling pollution has therefore been legislated in many forms and these measures are increasing in quantity in proportion to increasing identification and the expansion of the problem itself. As research and data continue to accumulate additional amending actions are expected to be enacted by the government. Not only water pollution, but pollution of the air, or soil by solid wastes radiation, pesticides, noise, or toxic substances is now the responsibility by mandate of Congress and Reorganization Plan No. 3 of a single, unified, independent agency of the government.

Agency History

The United States Environmental Protection Agency was established through the directives of Reorganization Plan No. 3 and officially commenced on December 2, 1970. The overall task was to clean up and to prevent the pollution affecting human health and land. Authority for this task

was derived from at least fifteen environmental control programs within various departments of the Federal government, prior to 1970. Additional significant laws of the 1970's directly cite the USEPA as the administering authority, in many cases with enforcement powers of its own or available through Federal procedures and court system. Empowering authority and responsibility for aspects of measures prior to 1970 were transferred to the Administrator of the Agency upon creation of the USEPA. Air pollution control came from the U. S. Public Health Service, water pollution control powers came from within the Departments of Health, Education and Welfare, and the Interior, solid-waste management derived also from within the Department of Health, Education and Welfare, pesticide regulation was switched from the Department of Agriculture, radiation administration was removed from the Federal Radiation Council (which was then abolished), and the major responsibility for noise pollution control plus advisory action came from and remains in conjunction for aviation noise control with the Federal Aviation Administration (FAA). (Education and Manpower Staff Office of Federal Activities, 1975, p. 1-43)

The committment given to the control and abatement of pollution by the government became integrated and co-ordinated with the establishment of the USEPA as a regulatory agency responsible for administering laws on control of air

and water pollution, solid-waste management, pesticides, radiation, noise, and toxic substances. According to the President of the United States, this Agency formation was "...to consolidate the major environmental pollution responsibilities of the Federal Government...to effectively ensure the protection, development, and enhancement of the total environment." (Council on Environmental Quality, 1970, p.25 and viii)

Agency Organization

The basic statement of organization for the USEPA is stipulated within Title 40, Part 1 of the Code of Federal Regulations. Above all else, it is the purpose of the Agency to, "...protect and enhance our environment today and for future generations to the fullest extent possible under the laws enacted by Congress." (USEPA, 1977a, p.1) To control and abate pollution in the areas of air, water, solid waste, pesticides, noise, and radiation is part and parcel of the Agency's responsibility to mount an integrated, co-ordinated attack on environmental pollution in conjunction with State and local government cooperation. To achieve its objective and meet these responsibilities, the Agency functions through: standard setting, enforcement programs, monitoring programs, research and development, financial and technical assistance, work force and general education, sharing of domestic responsibilities and sharing of inter-

national responsibilities. The structure for such functioning is most readily outlined by Appendix A. (USEPA, 1977a, p.1)

Within the Agency there is an Administrator with primary authority in all matters. Directly under this Administrator is a Deputy Administrator to whom most other parts of the Agency report directly through various portions of the chain of command. Assistant Administrators head the six major areas of planning and management, enforcement, water and hazardous materials, air and waste management, toxic substances, and research and development. Under these areas are the main categories of administration, planning and evaluation, resources management, general enforcement, water enforcement, mobile source and noise enforcement, pesticide programs, water planning and standards, water program operations, water supply, air quality planning and standards, mobile source air pollution control, noise abatement and control, radiation programs, solid waste management programs, toxic substances, air-land and water use, energy-minerals and industry, health and ecological effects, as well as monitoring and technical support, which are headed either by Deputy Assistant Administrators (DAA) or Directors. These DAA are linked directly to the proper major area and report to the DAA of that area in the chain of command. Another

sub-division in the chain of command includes various specialized offices which report to the proper DAA or Director. It is through these office areas, categories, and specializations that the Agency conducts standard setting, enforcement, monitoring programs, research and development, workforce and general education as well as technical and financial assistance. There are eight other offices which report independently and directly to the DAA including administrative law judges, civil rights, federal activities, general counsel, international activities, legislation, public affairs, regional and intergovernmental operations. These offices also contain some sub-divided offices for more efficient operation. Thirdly, the regional offices report directly and independently in the chain of command to the DA and A of the Agency. These ten regional offices are headquartered in Boston, New York, Philadelphia, Atlanta, Chicago, Dallas, Kansas City, Denver, San Francisco, and Seattle. They are authorized to provide assistance to State and local authorities, industries, and citizens to help them solve environmental problems.

The Agency promotes environmental protection efforts at all levels of government by providing financial and technical assistance to State, regional and local jurisdictions. Encouraging voluntary compliance for private industries and communities or having State and local govern-

ments perform necessary enforcement activities has been the Agency approach to enforcement for meeting EPA standards. However, most Acts of Congress contain provisions for the Agency to follow, when the Agency is required to obtain effective plans for pollution abatement and to be sure developed programs are implemented. The Agency shares many of its enforcement authorities with the States according to details contained in legislation governing USEPA activities. (USEPA, 1977a, p.3)

Other offices and bureaus of the government, beyond the Agency, directly affect environmental quality in certain areas. This includes not only the Council on Environmental Quality which serves as the President's main advisor in the co-ordination of environmental matters at the Federal level (and recommended creation of the USEPA), but extends to: The National Oceanic and Atmospheric Administration, which researches global trends affecting the oceans and atmosphere; the Department of Transportation, concerned with highways, railroads, and air transport; the Department of the Interior, which administers public lands and natural resources; and the Federal Energy Administration plus the Energy Research and Development Administration, jointly co-ordinating and managing a national energy policy. Additionally the Department of Housing and Urban Development; the Department of Defense; the Department of Agriculture; the Department of

Health, Education and Welfare; all have activities which affect the environment. By law, the environmental impact of any government activity must be evaluated in Environmental impact Statements to be checked prior to implementation. The USEPA does this checking and publishes its determinations and written comments which are then made public information. (USEPA, 1977a, p.3)

Concurrent to all this, the Agency is involved in: international conferences; over forty projects in conjunction with the U.S.S.R.; information exchanges in environmental topics with Japan's government; and scientific data exchanges with more than fifty countries. The Agency also cooperates with the NATO Committee on Challenges of Modern Society; the Intergovernmental Maritime Consultative Organization; the Organization for Economic Co-operation and Development; plus U. N. offices such as the World Health Organization and the U. N. Environmental Program in sharing and meeting international responsibilities.

Examples of the specialized offices, and their functions can be illustrated by the representative area of Research and Development which sub-divides into four office categories, as previously cited, with specialized offices and tasks further sub-divided under them. The following list is used for easy identification and understanding to show the various linked offices and their major respon-

sibilities:

I. Assistant Administrator--Office of Research and Development (ORD)
   A. Deputy Assistant Administrator-Office of Air, Land, and Water Use
      1. responsible for planning a comprehensive research program on water supply and on municipal wastes, including waste water and solid and hazardous waste management;
      2. responsible for research on:
         a. the transportation and disposition of pollutants in the environment,
         b. area wide environmental management,
         c. pollution from non-point sources such as urban run-off and forestry activities (USEPA 1977g, p.2)
      3. Cincinnati based offices--
         a. Municipal Environmental Research Laboratory
            (1) Waste Water Research Division
            (2) Solid and Hazardous Waste Research Division
            (3) Water Supply Research Division (USEPA 1977p, p.3)
            (4) functions
               (a) waste water treatment and reuse
               (b) municipal sludge management and disposal
               (c) runoff pollution control
               (d) urban systems assessment
               (e) solid and hazardous waste disposal
               (f) recovery and reuse of waste disposal
               (g) waste-as-fuels
               (h) drinking water treatment and control (USEPA, 1977p, p.13)
   B. Deputy Assistant Administrator-Office of Energy, Minerals, and Industry.
      1. assesses, developes, and demonstrates pollution technology to mining and industrial activities
      2. plans and administers a comprehensive Federal energy and environmental research, development, and demonstration program (USEPA, 1977g, p.2)
      3. Cincinnati based offices--
         a. Industrial Environmental Research Laboratory
            (1) Resources Extraction and Handling Division
            (2) Industrial Pollution Control Division
            (3) Energy systems Environmental Control Division (USEPA, 1977p, p.3)

(4) functions
(a) research pollution control methods, technologies and systems
(b) development and demonstration of pollution control technologies
(c) support for guideline development
(d) environmental assessments
(e) technical assistance to regions and industry for all media from the following sectors of the economy: metal, finishing,inorganic chemicals, nonferrous metals, pulp-paper and wood, food products, organic chemicals, hazardous materials spills, oil spills and oil and gas production, coal extraction, waste as fuel, oil shale, industrial energy conversation, geother-mal-solar-and other advanced energy systems (USEPA, 1977p, p.10)

C. Deputy Assistant Administrator-Office of Health and Ecological Effects
1. studies implications of varying types and levels of pollution on human health and the environment (USEPA, 1977g, p.2)
2. Cincinnati based offices-
a. Health effects Research Laboratory
(1) Toxicology Division
(2) Water Quality Division (USEPA 1977a, p.3)
(3) functions
(a) conducts field and laboratory studies relating to effects on human health and welfare associated with
(1) automotive emissions
(2) chemical and biological contaminants in drinking water
(3) pollutants in recreational and shellfish-growing waters
(4) pollutants emitted from wastewater treatment plants
(5) land treatment and disposal of wastewater and sludge
(6) non-pesticide pollutants (particularly metals) typically reaching man through multiple routes
(b) develops models and test systems

for use in predicting human mutagenesis and carcinogenesis
(c) prepares critical reviews of the health and environmental effects of multimedia exposure to pollutants
(d) provides technical assistance to the Office of Water Supply and Regional Offices on the health effects of water contaminants. (USEPA, 1977a, p.90)

D. Deputy Assistant Administrator-Office of Monitoring and Technical Support
1. developing reference or standard environmental measurement and monitoring equipment, techniques, and systems
2. developing Agency-wide quality assurance programs
3. disseminating scientific and technical knowledge
4. providing mechanical support, including monitoring and analytical support to the Agency (USEPA, 1977g, p.2)
5. Cincinnati based offices-
a. Environmental Monitoring and Support Laboratory
(1) Physical and Chemical Methods Branch
(2) Biological Methods Branch
(3) Radiochemistry and Nuclear Engineering Branch
(4) Quality Assurance
(5) Instrumentation Development Branch (USEPA, 1977a, p.3)
(6) functions
(a) development of test procedures for analysis of water and wastes
(b) development of quality assurance techniques
(c) alternate methods evaluation and approval
(d) development and evaluation of automatic monitoring
(e) technical services ((USEPA, 1977a, p.4)
b. Environmental Research Information Center (ERIC)
(1) Regional Services Staff (USEPA,

1977a, p.3)

(2) functions

(a) to reorient and expand the concepts and methods of technology transfer for all ORD information transfer activity

(b) facilitate dissemination and exchange of technical information (ORD) findings to users both internal and external to USEPA (USEPA, 1977a, p.6)

E. Senior ORD Official-Senior ORD Official Office Cincinnati

1. additional Cincinnati based office--
   a. Support Services office (USEPA 1977a, p.3)
2. represents ORD and the Agency in dealing with private and community groups in Cincinnati
3. provides Public Information service to Agency functions locally
4. provides advice and counsel to USEPA Cincinnati officials on ineraction with communication media
5. provides support to research laboratories by furnishing common use facilities such as Electron Microscope, Microbiological Suite, Media Preparation facilities
6. provides direction and use to common use facilities user committees
7. serves as a focal point for international visitors to the Cincinnati Center
8. provides staff support to the Assistant Administrator for Research and Development in Cincinnati
9. provides interface with the office of Administration to assure provision of administrative services to ORD components. (USEPA 1977a, p.17)

Also Cincinnati based operations or other specialized offices, not within the ORD, including: radiochemistry and nuclear engineering branch, technical unit, office of administration, computer services and systems, contracts management, facilities management and services, personnel

management, accounting operations, library services, television unit, and an office of civil rights. Their respective links in the chain of command along with Cincinnati based operations under ORD, and two specialized offices that operate under the Office of Water and Hazardous Materials (OWHM) are best shown by the chart in Appendix B.

The two specialized offices under the jurisdication of OWHM are training and technical support divisions respectively titled the National Training and Operational Technology Center (NTOTC) and the Technical Support Division. A large portion of workforce and general education by the Agency is provided, distributed, or developed for other educational institutions and public dissemination by the NTOTC and other Agency workforce and environmental education endeavors.

Some of the early environmental training and education history was traced by James Sheehy in an unpublished, special report (1965). It states that

> A search of the records available indicate that the first training course conducted by the Public Health Service in Cincinnati occurred in March 1932, under the direction of J. H. Hoskins, Officer in Charge of the Field Station. The faculty and student rosters are shown in Appendix C. Looking at the names of the faculty is like looking at the names of individuals in a hall of fame--Streeter, Purdy, Butterfield, and Theriault.
>
> A period of sixteen years elapsed before the next formalized course was presented. Under the direction of Harold Streeter, Officer in Charge

of the Station, the courses "Stream Sanitation Practices" and "Advanced Training for State Bacteriologists" were conducted in March and April of 1948. Faculty and enrollees for the "Bacteriologists" had their picture taken on the steps of the old Kilgour Mansion.

In 1948 the name of the Station was changed to the Environmental Health Center under the direction of V. G. MacKenzie. In June of that year, Ernest P. Dubuque was assigned to the Center from the training group at the Communicable Disease Center to establish a training operation in Cincinnati. The Section he established was called the "Specialized Sanitation Training Section." In February of 1949 Harry P. Kramer joined the staff. During the first half of 1950, Dr. R. P. Myers, Dr. W. M. Ingram, and S. Kinsman became members of the EHC training operation. Mr. Kinsman was recruited from the Army Chemical Corps in charge of a Radiological Health Training Section.

The various sections and operating training units are shown schematically in Appendix D. As can be seen, in addition to offering courses in water supply and pollution control, the Specialized Sanitation Training Section started courses in 1950 in milk and food, 1951 in civil defense and in 1952 household sewage disposal systems. In 1955, personnel were assigned to start training activities in air pollution. In Fiscal Year 1956, the Specialized Sanitation Training and the Radiological Health Training were combined into the newly formed Training Program, under the direction of Mr. Kramer. The division of Environmental Engineering and Food Protection assigned personnel to the Program in Fiscal Year 1962 to start training operations in metropolitan planning. During the same year, personnel were transferred from the Training Program to the Division of Radiological Health's operations at Rockville to start a Biomedical Training Section. Two years later, personnel were transferred from the Training Program to establish atraining operation at the Southwestern Radiological Laboratory at Las Vegas. As is shown in Appendix D, a formal training section was established at the Occupational Health Field Station in Fiscal Year 1961. In 1965 three sections continued operating outside of the Training Program--Rockville, Las Vegas, and Occupational Health.

This brief history of training areas in Health, Education, and Welfare plus Public Health Service is an area currently delegated to the USEPA-NTOTC.

Environmental Crisis and Control

The Federal Role in Workforce Development: The Agency

The USEPA has a broad range of programs for workforce development, planning and training. Development and training activities of the Agency normally are conducted along two topical pursuits between environmental education and workforce development and training activities. This study is limited in attention to only workforce development and training activities of the Agency. In describing and identifying this Federal role in workforce development, several areas of importance emerge including: Agency workforce objectives, needs assessment, training grants and fellowships, operator and technician training, plus direct training under the auspices of the NTOTC. Assessment of perceived needs and commentary on available Agency options, the major points of this study, are drawn here and further developed in the problem, educational training, and water pollution control training sections. Budgetary cuts and their resultant limitations on options for Agency achievement of training objectives have had significant impact which must be considered. (USEPA, 1977g,p.56) Legislative authority of the Agency in the areas of air, water, solid waste, radia-

tion, and pesticides has been established in the legislative history and reiteration of the various acts with individual section citings of responsibility for organizing and managing workforce endeavors is not included here.

The major workforce objective of the Agency is

> ...to assure that there is enough skilled workforce in all sectors of the economy to meet USEPA's mission to abate and control pollution. All of USEPS's program activities require trained workforce to accomplish their goals. This, USEPA must assure that workforce in requisite numbers and skills are available at the times and places needed to get the job done. The intention of this objective is not that USEPA should build massive programs to train and supply all work force needs. Rather, USEPA should only develop programs to fill critical gaps which will not be filled by the free market mechanism.

(USEPA, 1972e, Section III, 1-A)

The Agency's

> ...workforce development and training activities now operate independently in the program offices under several different legislative authorities. Each of these Acts provides a different range of authorities for workforce development. These programs continue to operate in the same way they did before the establishment of USEPA. The strategies of these programs range in scope from meeting the workforce needs of just State and local governments to meeting the workforce needs of all sectors of the economy. The legislative basis for workforce development activities is so broad that each program can interpret its legislation in the manner necessary to support its goals. For instance, while there is a similarity in the workforce legislation affecting the Office of Air and Water Programs, each office perceives its goals in a markedly different way. In the training grants area, the Office of Air Programs (OAP) operates under the assumption that industry and the Federal government can meet their own workforce needs, but that State and local governments

> cannot. Consequently, OAP stresses building staff expertise in State and local pollution control agencies. On the other hand, the Office of Water Programs (OWP) sees its mission as training a percentage of all professional engineers and scientists needed in water pollution control throughout the country and in all sectors of the economy.
>
> In the case of direct training activities (NTOTC), both OAP and OWP are geared to upgrade State and local capabilities in pollution control However, the OAP restricts its training to State and local agency personnel, while the OWP goes a step further and attempts to build up capability in the States to operatd their own training programs. These contrasting goals reflect differing judgements about the legislative mandate of the offices; where their resources can have the most impact; and the capability of various sectors to meet their workforce needs. Each sector of the economy (private industry, Federal government, academia, and State and local governments) needs trained workforce to meet its responsibilities in abatement and control of pollution.

(USEPA, 1972e, Section III, 2)

Under the Agency's major workforce objective, goals concerning Agency relationship and involvement with each sector of the economy require identification and scrutiny. With regard to the goal of assuring enough skilled workforce in private industry, the Agency's position statement notes that while industry has environmental workforce needs it also has the resources to pay for any environmental training it requires. Ultimately, it has the ability to pass on the cost to the consumer. Therefore, USEPA's position is that it does not need to subsidize industry or develop programs to meet industry's workforce needs. This

policy view reflects assurance that the goal for enough skilled workforce in private industry does not require involvement of the Agency with private industry to achieve workforce training in that sector. This policy is also cited as being consistent with the President's policy of internalizing the costs of pollution control.

To assure enough skilled workforce in other Federal agencies is another goal which has received a negative response from the Agency. There is recognition that in addition to USEPA, other Federal agencies also need trained personnel to meet their pollution control responsibilities. These agencies, however, are considered by USEPA to have the resources to attract and train skilled workforce. Federal salaries are viewed as competitive with industry at all but the very top levels. So the policy emerges that no USEPA "Subsidy" of other Federal agencies is required. (USEPA 1972e, section III)

In assuring enough skilled workforce in universities, the Agency view notes that there are existing needs for highly trained professionals to educate an increasing number of environmental managers. But policy statements at this particular time, noting that due to both a large number of unemployed and under employed highly educated professionals and a resultant soft market, that universities have little problem attracting highly educated teachers. Over the last decade, it is additionally recorded that USEPA, or its

predecessor agencies, has provided training grants which include institutional support for faculty, equipment and curricula development. It is felt that this support will continue as long as there is a demonstrable need for degree level people in the environment, and that no other support is deemed necessary. (USEPA, 1972e, section III)

To assure enough skilled workforce in State and local government is the final sector-by-sector goal consideration. The Agency policy includes the view that State and local governments have major pollution control responsibilities under Federal law. However, they lack financial resources to compete with private industry and the Federal government in recruiting and retaining skilled employees. Since the President's policy of revenue sharing is based in part on the assumption that States and localities are reaching the limit of their sources of funding, direct Federal assistance to States and localities to develop sufficient workforce to carry on their pollution control responsibilities is recorded as consistent with present Agency efforts to provide these sectors with major subsidies through program and construction grants. (USEPA, 1977e, Section III,3)

Considering the assurance of enough skilled workforce in all sectors as a goal must reflect negative as well as positive positions due to varied individual sector policy stands. The sector-by-sector consideration of goals pre-

sented indicates that all sectors of the economy, other than State and local governments, have in the present Agency view sufficient resources to meet their own needs. The conclusion which is drawn then is that it is not deemed cost effective for USEPA to support all sectors. Obviously having identified these various goals, positions, and conclusions or policy stands; scrutiny aspects including more detailed data, assessment, analysis, and evaluation are inherently important to the aim of this study. This is especially true in view of these two reported recommendations of the Agency:

> (1) to assist the states and localities to staff their pollution control agencies and upgrade the skills of their employees, and (2) to assist the states to develop, when possible, their own training programs.

(USEPA, 1977e, section III, 4) In establishing the primary goal of the Agency workforce activities of development and training.

Regarding needs assessment of workforce activities, it is reported that

> The program offices have expended relatively little resources to assure that their training programs accurately reflect actual [workforce] needs. While it is difficult to estimate what the appropriate mix should be between expenditures for needs assessment and program operations, it is apparent that at least a good order of magnitude assessment must be performed to give proper direction and scope to program development.

(USEPA, 1977e, section IV,1) In spite of these notations,

however, only legislative requirements from the Congress have provided impetus for the initial needs assessment study by the OAP and two assessment studies by the OWP. The first attempt at comprehensive workforce assessment was the 1967 Congressional mandated report, "Manpower and Training needs in Water Pollution Control". This report depicted a lack of current or reliable data on which estimates of future needs could be based. In this report the needs of the Federal sector were completely omitted. Until required by the later Congressional mandate to submit an updated 1971 needs assessment report, the OWP had virtually ceased its assessment activities following the initial report. The updated report resulted from a portion of the Water Quality Improvement Act of 1970. The OAP has updated its first report to Congress, of its own accord, in order to reflect changing conditions. These changes were, however, mainly a result of requirements of the 1970 Clean Air Act. Further, the methodology and uses made of the findings in this updated report were later seen by the Agency to reflect two flaws. These flaws were a lack of sophistication in approaching needs assessment, and an inability to shift program emphasis to reflect changing needs as they were becoming known. (USEPA, 1972e, section IV-2). The Office of Solid Waste Management Programs (OSWMP) similarly responded to a 1970 Congressional call for an assessment of workforce needs in the

solid waste field. This call only occurred after several years of operating a training grants program and an extensive direct training program. As late as 1972, the Office of Pesticides and Radiations Program had no needs assessment programs and no plans for establishing any. Until quite recently the rationale for lack of assessment has been a generally accepted assumption that the Agency ought to be training as many environmental scientists and engineers as possible. Additionally, it was assumed that future demand for personnel in this field would increase at a large geometric rate. Needs assessment was, and in some cases still is, limited to an after the fact survey of graduates from USEPA funded training grant programs to determine if they had any difficulty finding employment in their field. Part of the current problem reflects a basic conflict in the program offices between day-to-day pressures from operational responsibilities and the need to do long range planning for future program development. When such conflicts occur, the planning aspect suffers most drastically. (USEPA, 1972e, section IV-1 and 2). A more detailed consideration of aspects of the assessment needs problem is contained in the problem section of this chapter. Professional training grants and research fellowships are an important segment of the battery of Agency activities in workforce development and training. Training grants have received a tri-focused report treatment by the Agency

involving: changing management of the training grants program, making the Agency training grants more cost-effective and competitive, and reducing or shifting training grant funds to meet the budget cut and other USEPA priorities. The Agency has considered options and recommendations relating to each of these three reported points of issue on training grants. (USEPA, 1972e, section V) The professional training grants are awarded to educational institutions for the establishment, expansion, and improvement of graduate level programs in water pollution control as well as air progrms, radiation programs, and solid waste management. (USEPA, 1973L, p9) Through 1972, the Office of Pesticides Programs had no training grants program. Most of the programs are intended to produce trained professionals who are prepared to contribute to management quality in their respective area through subsequent positions in teaching, research, consulting, or direct operation in the public or private sectors. Grant funds can be used for student stipends as well as to expand and improve staff, facilities, and equipment. A normal training project of five years duration contains renewable grants that are awarded annually for one year cycles. Evaluations of cost per student between the sixties and seventies generally record decreased costs, yet such assessments have been greatly varied in quality and quantity in the various areas.

The purpose of research fellowships has been to support selected research training by graduate students in the pollution control areas. The expected outcome has been to increase the number and competence of engineers and scientists qualified to conduct independent research and advanced practice in conjunction with teaching at the graduate level. Generally these awards are made on a competitive basis. Most of them are given to doctoral candidates in engineering physical sciences, biological sciences, or socioeconomic disciplines. Very little co-ordination between program office practices have occurred. When one program office has reoriented its training grants, it has not held that the other offices also change. This lack of multi-disciple co-ordination has become an identified weakness. It has also had the effect of preventing fund transfers to areas of greatest need or current priority. Though reports reflect improving cost ratios, greater effectiveness and efficiencies are still unfulfilled requirements.

Opening conference comments by James D. Goff as Moderator of the National Environmental Manpower Planning Conference reinforce some previous points and includes commentary on the state and condition of technician and operator training in the manpower planning, development and training activities of the Agency.

...in the area of planning the government was

caught short. Basic planning at the Federal level represented some of the first efforts and pointed up the need for more local involvement in planning and commitment to its implementation. The whole planning process went through a process of evolution,....we now hope to witness significant progress.

In spite of this tremendous thrust forward made in environmental planning at the State and local levels, there remains a planning element inadequately covered in the overall planning process, and that's the area of manpower planning.

Manpower planning,...,is as important a plan element as any other in the closely connected scheme to get the job done, and we need to stress this no further.

At the professional manpower development level, the Federal Government has provided scholarships and training grants to train hundreds...This has been a high accomplishment,... it's doubtful that the Federal Government will be able to continue this program beyond June of 1976.

At the subprofessional level (technician and operator training), EPA has had to depend primarily on the Department of Labor Manpower Development and Training Act, MDTA funds, for training water works and waste treatment plant operators and more recently, landfill operators, vehicle inspectors, instrument technicians and pesticide applicators.

...there have been some excellent training programs in these fields. So, with the passing of MDTA and what appears to be little funding directly available through EPA authorizations, we must look to other funding sources,...

...The subprofessional training activities which EPA carried on with limited MDTA funds were not intended of course, to meet our massive environmental training needs. Rather, these programs were really designed to develop State and local training capabilities to the point where most jurisdictions could have an ongoing environmental training delivery system.

...certain specific manpower needs which should be considered at this time. (1) The training of water and wastewater treatment plant operators at both the entry and upgrade level. (2) Training of instrument technicians involved with ambient air quality monitoring and training

> of vehicle inspectors for mobile source control. (3) The training of sanitary landfill operators for handling and disposing of solid and liquid hazardous waste. (4) Training of pesticide users at various levels of application. (5) Training of noise monitoring technicians and inspectors. (6) The training of emergency response personnel who would be involved with nuclear accidents. There are many others, of course.
>
> ...One of the most pressing needs in the fullfillment of the national and state air pollution control strategies is the training of instrument technicians, aimed at heightening our data quality assurance...,the manpower needs in water pollution control are expected to increase greatly in the years ahead...Another major area is that of solid and hazardous waste... EPA is making specific nationwide training efforts in the area of toxic and hazardous materials, ...(and)...is particularly requiring of manpower development and training...Finally,...not neglect two often overlooked training challenges: noise control and radiation surveillance...
>
> In summary,...deal with manpower training and development implications of all our environmental programs.

Direct training activities demonstrated the intention of the Agency to achieve the most immediate impact toward improving the capability of environmental control workforce on a national basis. Financing of this direct training was in the multi-million dollar bracket through the mid-'70's. Consideration of shifts and changes since that time are found in the problem section as half of the dually focused aim of this study, and details of operation, background and theory are so synonomous with operation and details of NTOTC that they are considered in that portion of this chapter.

NTOTC In Workforce Development

The official objective of the NTOTC is to assume responsibility for all operational aspects of planning, developing, conducting, and evaluating of training activities in the Agency. This is intended to assure an adequate supply of trained workforce to implement a water pollution control abatement and control program at Federal, State, and local levels. Under the jurisdiction of the OWHM, NTOTC maintains full-time professional staff. This staff is qualified in scientific disciplines ranging from aquatic biology to bacteriology, chemistry, and sanitary engineering. In working closely with water pollution control programs, NTOTC contacts national, regional, State and local sectors to identify and characterize workforce and training requirements. The NTOTC also plans, develops, and conducts short-term training courses scheduled as an annual curriculum dealing with causes, prevention and control of water pollution. Personnel from Federal, regional and State and local agencies, plus individuals from educational institutions, the private sector of this country, and other countries, all attend these courses. (USEPA, 1977b, p.17) Examples of four short term training courses being currently offered are: "Inorganic Analyses in Water Quality Control Programs", "Organic Analyses in Water Quality Control Programs", "Analytical Methods for Trace Metals", and

"Bacteriological Methods in Water Quality Control Programs". These particular courses concentrate on the analysis of wastewater treatment plant effluents and ambient water, emphasizing the use of Agency approved methodology for the development of water quality data required by regulatory agencies at Federal and State levels, as well as some other organizations. (USEPA, 1977-78j, side one)

To achieve the official goal, NTOTC functions in three ways: information management, data processing, and with course presentations. There are five approaches incorporated in the performances of information management by the NTOTC. In the Instructional Resources Center at the NTOTC, current training materials are available for review by instructors. A series of audio-visual presentations are also available to instructors on a short term loan basis. Further, in the Instructional Resources Information System, a computerized listing of over 2700 water quality training materials is maintained. Staff members in the NTOTC act in a consultative role and assist state agencies, municipalities and educational institutions as much as they can, and communications with the educational community are maintained, where possible, to determine support needs. The data handling consists primarily of the audio visual instructional units which are available for loan. These units include: audio cassettes, filme, television units, and slide/tape units,

and in quantity number nearly three hundred. In course presentations, staff members plan, develop and conduct a program of short-term technical training courses, primarily for personnel of public agencies on causes, prevention, abatement and control of water pollution. Additionally, there are demonstration courses on upgrading the operational methods at wastewater treatment plants conducted to improve procedures and effluent quality as specifically mentioned in the course title listings above. A fourth function of the NTOTC involves materials development, where the NTOTC determines appropriate educational methods that will promote water quality concepts and monitoring and surveillance procedures.

Summary of Current Problems

Direct training activities prior to 1973 emphasized immediate development and training priorities with little balancing planning. The Agency's intention was clearly to provide the most immediate impact to improve the capability of environmental control workforce on a national basis. The purpose was aimed at three points:

> ...to provide a continuing, comprehensive program of specialized and advanced technical training generally unavailable elsewhere.
> ...to research and develop instructional technology, and to provide an instructor development program for individuals responsible for and/or conducting environment training or related activities.

> ...to provide, on request, instructors and/or training materials in support of the training program of other Federal, State and local agencies.

(USEPA, 1973 L, p. 13)

Primarily through fellowships and training grants, hundreds were trained to assume lead roles in environmental jobs. They were expected to be the conductors and providers of requisite immediate access to new techniques and knowledge developed by Federal research and development staffs and those of co-operating institutions and agencies, not only for themselves, but for the practicing professionals already in the field.

Investment in these training grants, fellowships, and direct training activities were annually topping figures in the multi-million dollar range, but the corollary output reflected high accomplishment. During the period 1973-1976, a reorientation of program objectives occurred in the Agency due to a combination of: actual, current workforce needs; large budgetary cuts; and legislation revenue sharing in the "Comprehensive Employment and Training Act of 1973" (CETA). Decentralization and decategorization emerged as key words during this period and up to the present time. Three concepts of the Agency became clarified in the development of effective direct training under the reorientation:

> (1) Direct training must closely reflect the latest policies of the program offices and the AGency. (2) Direct training must transfer the latest relevant technology to the student. (3) Direct training must encourage synergism among EPA program

areas and facilitate cross-fertilization of ideas. (USEPA, 1972e, section VI-2)

One result has been that the government is not providing direct contracts and grants for education and training to the degree it has previously done. EPA has been assuming a catalytic role involving the technical aid and stressing of the planning process now, providing policy guidance and other staff expertise in its own area of competence.

A clearer definition of objectives to be attained and a sound, agency-wide workforce needs assessment program are logically essential to administering a multi-million dollar training program. Yet since workforce revenue sharing is still a relatively new concept, especially in the area of environmental workforce, the Agency as well as state and local governments have not identified the impact on their situations. One Agency report summarized the situation in this way:

> A detailed study of direct training would require considerable travel to State and local control agencies and to direct training sites across the country. A more detailed evaluation of the outputs of direct training is essential...Time restraints did not permit as thorough an examination of direct training activities as the survey of EPA's training grants and fellowship programs..
>
> ...Survey of the program offices' direct training activities revealed that little is being done to assess needs as a basis for program development. Program content is left largely to the professional judgement of the instructors and curricula development personnel. The most common method of initiating a new course is for the instructor to

> design it and then solicit interested parties, rather than develop a course to meet a set of identified needs and priorities.
>
> Planning of direct training courses is usually based on the previous year's work. Each program office plans independently of the other, even though the courses are often designed for the same participants in State and local control agencies. (USEPA, 1972e, section VI-1)

Many of the practices of the Agency fall short of written theory statements, goals, and role fulfillment, as indicated by the above quote.

CHAPTER III

DESIGN OF THE STUDY: METHODS AND PROCEDURES

Introduction and Setting

This chapter was devoted to the methods and procedures of the research. The setting, the sources of data, the development of questionnaires, the refinement of instruments, the data collecting procedures and methods, and the methods used to analyze and report the data collected are included in this chapter. This study centers on the educational training needs assessment in the field of water pollution control and the appropriate role of the USEPA with educational training in the field of water pollution control. The study used three approaches for the collection of the data. One approach was a descriptive survey used as a general research technique within the confines of the United States. (Babbie, 1973, p.59) Data obtained from "Water Quality Instructors' Workshops" held at the NTOTC of the USEPA constituted the second approach. A select number of on-site interviews at educational institutions required over 12,500 miles of travel in the contiguous United States, and

comprised the third approach. The four units of analysis were contacted through the survey, ranging from water pollution control training instructors to students, as well as program directors or deans, and field-related employers. The purpose of surveying these four units of analysis address the need for properly educated staff to train water quality personnel (workforce development); development of refined education/training objectives, and the need for accessible, high quality, appropriate, up-dated materials in water pollution control. The purpose of the survey included up-dated and detailed data and assessment perspectives from the four units of analysis. The second approach for data collection consisted of the use of the descriptive survey technique documents completed by participants in the workshops. Interviews during on-site conferences at selected water quality training centers throughout the United States was the third approach for date collection and permitted the interviewing of program directors or deans, instructors, and some students.

The reported recommendations of the USEPA were to assist the states and localities to staff their pollution control agencies and upgrade the skills of their employees, and to assist the states to develop, when possible, their own training programs. In view of these primary goals of the Agency in establishing goals for workforce development

and training, and later indications depicting a lack of current or reliable data on which estimates of future needs could be based, the focus of this study took form. Further, methodology flaws, as shown in Chapter II, were noted with regard to reports and updating reports on the topic reflecting a lack of sophistication in approaching needs assessment, and an inability to shift program emphasis as changes became identified. Needs assessment was and in some cases still is limited to an after the fact survey of graduates from USEPA training grant programs to determine if they had any difficulty finding employment in their field. (USEPA, 1972e, section IV-1) A basic conflict in the program offices between day-to-day pressures from operational responsibilities and the need to do long range planning for future program development reflects part of the current problems. (USEPA, 1972e, section IV-2) A clearer definition of objectives to be attained and a sound, agency-wide workforce needs assessment program are logically essential to administering a multi-million dollar training program, and a main portion of the basis for this study. Further basis for this study was substantiated by an Agency report stating that,

> ...a detailed study of direct training would require considerable travel to State and local control agencies and to direct training sites across the country. A more detailed evaluations of the outputs of direct training is essential...

> Time restraints did not permit as thorough an examination of direct training activities as the survey of EPA's training grants and fellowship programs...survey of the program offices' direct training activities revealed that little is being done to assess needs as a basis for program development. Program content is left largely to the professional judgement of the instructors and curricula development personnel. The most common method of initiating a new course is for the instructor to design it and then solicit interested parties, rather, than develop a course to meet a set of identified needs and priorities. (USEPA, 1972e, section VI-1)

Additionally each program office plans independently of the other, even though the courses are often designed for the same participants in State and local control agencies with planning of direct training courses usually based on the previous year's work. (USEPA, 1972e, section VI-3) This situation and practices of the Agency fall short of written theory statements, goals, and role fulfillment, and are points to which this study are addressed.

The main resources for this study was provided by the facilities of the USEPA, NTOTC in Cincinnati and the University of Cincinnati, College of Education and Home Economics, Department of Curriculum and Instruction. This includes library documents and services available at these two locations, the Behavior Sciences Laboratory of the University of Cincinnati in conjunction with the University of Cincinnati Computer Center Services, and funding under Agency grant resources. Office space was provided by both the University of Cincinnati and the USEPA at Cincinnati to

meet facility needs. Equipment consisting of audio-visual machines and office furniture were also provided by the University of Cincinnati and USEPA at Cincinnati. General office supplies and audio-cassette tapes for interviews were also used for this study.

Design of Instruments

Descriptive survey instruments utilizing the questionnaire method were designed for each of the units of analysis; students (Appendix E), instructors (Appendix F), deans or program directors (Appendix G), and field-related employers (Appendix H), in collecting data which was analyzed to define the needs for water pollution control training in programs across this country. Each of these four instruments was developed from reviewing existing water pollution control training programs and consulation with field personnel. Supplementing the descriptive survey design involve some exploratory surveying, due to incorporation of the multivariate analysis, as well as an exploration survey which preceded the controlled study. These three basic organizing principles in design of various steps of the surveying allow the best possible compromise for all the necessary survey designs. (Babbie, 1973, p.57-59) The instrument (Appendix I) used in the workshops was designed

with consultation from subject and training experts in the field. Summary session reports were also consulted for data. In the on-site visitations, a combination of instruments was used, including the formal written instruments (Appendices E, F, G, H) developed for the mail surveying, plus some direct observation information, and interview recorded information (Appendix J). The oral interview questions (Appendix J) were designed with the assistance of staff members of the Department of Curriculum and Instruction of the University of Cincinnati and the staff of the NTOTC of the USEPA.

Questionnaires were distributed to representational random samples of the identified populations for each unit of analysis. These questionnaires for the controlled study used a cross-sectional study design with paralled-samples. (Babbie, 1973, p.61) Closed-ended questions with Likert scale responses were used on these questionnaire instruments. (Babbie, 1973, P.140)

Design of questionnaires in the exploration portion of the overall study were implemented according to loose questioning for individuals not part of a representative sample population, and not conforming to any standard form of data aggregation. The intention of such a "search" was to check factors for the research design and avoid significant osissions. It is felt that significant information

can be obtained in the subsequent controlled study in this manner and from the use of four units of analysis. Further the selection of four units of analysis was proven to have avoided ecological fallacy in support of their correctness. Selection of members of the various units of analysis are according to the groups to which they belong rather than any basis of components. (Babbie, 1973, p.60)

Sampling Procedure

Government publications were used to identify educational institutions involved with water pollution control training programs or projects. To make this study the most effective possible, mailing lists were obtained from several sources: (1) educational institutions, divisions and departments directly involved with water pollution control training; (2) USEPA and NTOTC; (3) other governmental publications; (4) Ohio and other state manufacturing associations; and (5) nationwide public telephone directories. Personal contact was made with instructors, program directors or deans, and some students during on-site visitations. A selected random sampling of identified educational institutions was surveyed. Public telephone directories, a list of Municipal Water Treatment Facilities and the Ohio Manufacturing associations as well as other state association membership rosters were consulted in locating water pollution control employers. Questionnaires were sent to the

randomly selected educational institutions, businesses, associations, and governmental agencies from these identified samples.

Methods of Collecting Data

Interviews and questionnaires based upon a cross-sectional study design with parallel samples for the four units of analysis have been selected over other methods (controlled experiment, content analysis, or participant observation) as the most appropriate method for this study. This selection involved consideration of the scientific characteristics of all survey research, which has shown survey research is: logical, deterministic, general, parsimonious, specific, and provides a permanent source of information through collection and quantification of data. Beneficial portions of the other three methods which are important in the survey research method were also considered. (Babbie, 1973, p.45-49)

The specific selection of the survey research design, cross-sectional study, over longitudinal, or use of cross-sectional study to approximate longitudinal study was based on the aim of collecting data at one point in time from samples to describe the larger populations upon which each unit of analysis was based. It was further expected to allow avoidance of frustrating complexity that might prevent

achievement of the goals and objective of the study in consideration of time and instances, as they were available. Incorporation of a variation of the basic survey design through parallel samples acknowledged that the study was relevant to more than one group as reflected by the selection of four units of analysis. Variations based on contextual studies or sociometric studies were excluded from consideration based on the respective requirements in which data must be identifiable with the respondents' context and use of intact groups. (Babbie, 1973, p.62 and 66)

The questionnaires were sent or given to selected members of the four units of analysis. Questionnaires and variations were developed for each of the units of analysis. The questionnaires were made according to accepted standards for construction, format, instructions, precoding, and reproductions.

Questionnaires were sent to the four units of analysis. Different questionnaires were developed in an appropriate manner for each of the four units of analysis. Enclosed with each questionnaire was a cover letter (Appendix K), with an introduction and purpose of the study clearly stated in it, and a metered, self-addressed envelope for return mailings.

Questionnaires were readily identified by precoding through use of four different color of copy paper, and

tabulations were carefully recorded. Russet color paper was used to code student surveys (Appendix E), blue color paper was used for instructor surveys (Appendix F), deans or program directors surveys were coded with yellow copy paper (Appendix G), and green copy paper was used to code surveys for the field-related employers (Appendix H). The initial mailing was made on February 15, 1979. A follow-up letter (Appendix L) with additional questionnaires attached was sent to individuals that had failed to initially respond. This letter (Appendix L) was expected to remind and reinforce the importance of this study and maximize response rates. (Babbie, 1973, p.164) Five hundred had been mailed at that point. In an additional month, a second group mailing was made on March 12, 1979; following the same procedures as the first mailings. A cumulative total of 3,000 surveys were mailed by this time. This figure resulted from 800 surveys of students, 500 surveys of instructors, 200 surveys of deans or program directors, and 1,500 surveys of field-related employers (Appendix M). Contact levels and numbers of questionnaires varied according to the unit of analysis and mailings were adjusted, including follow-ups, to the most appropriate, compatible level that could be determined for each group as a unit of analysis. The recorded return rates were five hundred thirty-six surveys from students, three hundred forty-seven

surveys from instructors, one hundred one surveys from deans or program directors, and nine hundred seventy-three surveys from field related employers (Appendix M); with percentage calculations and other information given in Appendix M, for a total of one thousand nine hundred fifty-seven usable returned surveys.

Since all members of an initial random sample rarely complete and return their questionnaires, consideration of response rates was important (Babbie, 1973, p.165) and it was assumed that the respondents were a smaller random sample of the initial random sample. (Appendix M) In Survey Research Methods (1973), Babbie reported that a minimum fifty per cent response rate is "adequate" for analysis and reporting; a minimum sixty per cent response rate is "good" and a minimum seventy per cent response rate is "very good". He stipulated that response rates are not as important as demonstrated lack of response bias, and that his percentages have no statistical basis. Following the accepted practice, all questionnaires that could not be delivered (due to insufficient addresses, or other similar reasons) were omitted in computing the response rate (Appendix M). This was based on the logical assumption that non-deliverable questionnaires represent a random sample of the initial sample. In the response chart, Appendix M, the initial sample sizes are indicated, then the number of non-

deliverable questionnaires were then subtracted. The number of completed and returned, usable questionnaires were divided by the net sample sizes to establish the response rates. (Babbie, 1973, p.164)

An appropriate number, kinds and types of question, one hundred thirty-three, were involved in the surveys (Appendices E, F, G) of students, instructors, and deans or program directors. The questions for these surveys and the survey in Appendix H were based on accepted standards for survey research. The one hundred thirty-three survey questions covered four topical areas: curriculum content, teaching skills, materials format type, and attitude assessment. Sixty-nine questions in the curriculum content area, fifteen questions in the teaching skills area, fifteen questions in the material format type area, and thirty-four attitude assessment questions comprised these surveys (Appendices E, F, G). The field related employers' survey did not contain questions in the teaching skills area or materials format type area, since they would have been inappropriate. The final unit of analysis survey (Appendix H) has one hundred three total questions in just two areas. A limit was applied to the number of questions to increase efficiency, encourage completion of responses, and to facilitate tabulation of data. Accumulated data from the various units of analysis was aggregated in separate data

files, with cumulative totals where appropriate. They are presented, ordered and analyzed in chapter four to permit the most significant conclusions to be drawn for basing a good solution to the study, as well as for prime readability, and for clarity of ideas and conclusions to be expressed.

Data was collected with an assured one hundred per cent return rate at the workshops through supervised administration, completion, and collection of those surveys. Date from the on-site visitation conferences was collected through use of audio tape recordings and later compiled. Surveys were given for completion in a manner similar to the mailed surveys.

Validation of Instrument Procedure

To fully validate the questionnaires for the controlled study, the following procedures were followed:

(1) An exploration survey preceded the controlled study. This involved loose questioning of individuals not part of a representative sample population, and did not conform to any standard form of data aggregation. The intention of such a "search" was to check factors for the research design and avoid significant omissions.

(2) Both the exploration survey and the controlled study were distributed to college level educators for expert guidance and rating which was incorporated through improving revisions (Appendix N).

(3) The exploration survey was additionally used to obtain opinions and rating with regard to question content, construction, and other format details and design.

(4) Closed-ended questions using formal responses on a Likert scale were formed using accepted, standard guidelines requiring clear items, avoidance of double entendre questions, keeping questions relevant, using short items whenever possible, avoiding negative items as possible, and excluding "biased" items and terms as much as possible. (Babbie, 1973, p. 140-145) Additional considerations of the general format, ordering of the questions, instructions, and questionnaire reproduction followed accepted standards in survey research design.

(5) The interview instrument (Appendix J) used the accepted general rules of interviewing with regard to appearance and demeanor, familiarity with questionnaires, following question wording exactly, as well as exactly recording and probling for responses. (Babbie, 1973, p.181-186)

(6) The method of mail distribution and return has been presented. These returns and follow-up mailings were carefully monitored, as previously mentioned. Response rates were calculated and carefully considered along with response bias evaluation.

The validity and reliability of the attitude

assessment area of the controlled study survey was based upon the Purdue Master Attitude Scales (Remmers, 1960) since this single scale could validly measure attitude toward any one of a large number of specific attitudes with a known, adequate degree of reliability. These scales have demonstrated validity both against Thurstone's specific scales and in differentiating among attitudes known to differ among various groups. Samples of experimental studies carried out to construct and validate these scales are cited completely in Appendix O. The usual use of these scales in a group study has shown that the reliabilities of means is sufficiently adequate.

Statistical Design of the Study

Tables are utilized to present data and to designate all the pertinent information directly related to the water pollution control training needs assessment and perceived needs for Agency involvement in the field.

The aggregation of survey data was completed by several steps. The surveys were given confidential IDs and the responses on them were recorded on direct punch sheets. These sheets were punched onto data cards by the University of Cincinnati Computer Center Service and the cards were subsequently recorded on magnetic computer tape in duplicate to assure backup data and for efficient

computer analysis. In order to interpret the data, an SPSS file was created and from this file all the data analysis was computed.

Data in the curriculum content and teaching skills areas was compiled in a four step analysis. First reliability scores were computed for curriculum content and teaching skills areas to determine if sufficient reliability existed among the answers to warrant treating the mean sum of each area as a single variable, with four variables per case the result. The variables were curriculum content acquired, curriculum content desired, teaching skills acquired and teaching skills desired. The second analysis, a One Between-One Within Manova was computed to determine if there were any differences among the units of analysis regarding the four variables. The third analysis step was to perform a Scheffe Procedure for Analysis of Variance using the average score for the combined acquired and desired variables for the first two topical areas, resulting in two variables per case. This analysis determined among which units of analysis the differences occurred. The final analysis again used the Scheffe Procedure for Analysis of Variance, this time computing with the four initial variables per case: curriculum content acquired, curriculum content desired, teaching skills acquired, and teaching skills desired. This

determined where the differences occurred among the units of anlaysis for each of the four variables. Data from the third area of the mailed surveys, materials format type, was anlayzed with the use of frequency tables to compile percentage scores. (Appendices P, Q, R, and S) The fourth area of the mailed surveys, attitude assessment, used a standardized instrument, The Purdue Master Attitude Scales (see Appendix O for the manual of this instrument). It was scored according to indicated procedures.

Any information that was obtained from questions requesting a written response from surveyed individuals is listed accordingly. Appropriate narratives precede each table listing to explain the significance of the material they contain.

CHAPTER IV

PRESENTATION AND ANALYSIS

Introduction

This chapter contains a presentation of the questionnaire return rates; reliabilities; One Between-One Within Manovas; Scheffe Procedures for Analysis of Variance; and frequencies plus interpretations of the results and notations of statistical significance concerning data gathered through the mail surveys. Summarized information with regard to "Water Quality Instructors' Workshops" is then presented in a descriptive form. On-site conference information is also summarized and presented in a descriptive form.

Controlled Study Mail Surveys

Questionnaire Return Rates

Four questionnaire groups were compiled and analyzed. The data concerning the responses is presented in table form and Appendix M. Each questionnaire was analyzed separately when appropriate. Clarifying comparisons among

the surveys has been included at times as deemed beneficial. Percentages have been rounded to the nearest tenth of a percent for accuracy and clarity.

The 3,000 questionnaires were mailed to identified members of the four units of anlaysis: (1) students, (2) instructors, (3) program directors or deans, and (4) field-related employers. Data pertaining to the mailing and return rates of the questionnaires sent are contained in Table 4.1 in summary and in Appendix M with all figures and percetage return rates.

Overall, the total return rates were very good, except for the program directors or deans population where the total return rate was still acceptable. No merging of units of analysis representing the population groups was required for analysis purposes.

Analysis of Data

The survey consisted of two hundred ninty-two separate items. This number was too large to deal with individually and would have been inappropriate to the objective of this study. Based on design aspects of the survey the items were categorized into four topical areas involving these variables: (a) curriculum content acquired, (b) curriculum content desired, (c) teaching skills acquired, (d) teaching skills desired, (e) material format types, and (f)

TABLE 4.1

"Mail Survey Population Groups and Questionnaire Return Rates"

units of analysis	net number sent	returns	percentage return rates
(1) students	780	536	68.7%
(2) instructors	490	347	70.8%
(3) program directors or deans	198	101	51.0%
(4) field-related employers	1,447	973	67.2%
all	2,915	1,957	67.1%

attitude assessment. Not all the variables and their various individual items were included on each unit of analysis survey, (see Appendices D, F, G, and H). In order to verify the intactness of the variables: curriculum content acquired, curriculum content desired, teaching skills acquired and teaching skills desired, a reliability check was run for all the items in each of these four variables for each unit of analysis. Data figures obtained from the computer program reliability checks of each unit of analysis are shown in Tables 4.2, 4.3, 4.4, and 4.5. An alpha co-efficient of 0.5 or better confirmed intactness of the variables.

TABLE 4.2

"Reliability Check for Unit of Analysis - Students"

variables	number of cases	number of items	alpha co-efficient
curriculum content acquired	524	69 (1-137 odd)	0.98329
curriculum content desired	524	69 (2-138 even)	0.98997
teaching skills acquired	530	15 (139-167 odd)	0.95336
teaching skills desired	530	15 (140-168 even)	0.93506

TABLE 4.3

"Reliability Check for Unit of Analysis - Instructors"

variables	number of cases	number of items	alpha co-efficient
curriculum content acquired	313	69 (1-137odd)	0.97207
curriculum content desired	316	69 (2-138even)	0.96058
teaching skills acquired	344	15 (139-167odd)	0.95925
teaching skills desired	341	15 (140-168even)	0.92659

TABLE 4.4

"Reliability Check for Unit of Analysis - Program Directors or Deans"

variables	number of cases	number of items	alpha co-efficient
curriculum content acquired	101	69 (1-137odd)	0.88666
curriculum content desired	98	69 (2-138even)	0.96769
teaching skills acquired	101	15 (139-167odd)	0.98518
teaching skills desired	101	15 (140-168even)	0.97791

TABLE 4.5

"Reliability Check for Unit of Analysis - Field-Related Employers"

variables	number of cases	number of items	alpha co-efficient
curriculum content acquired	897	69 (1-137 odd)	0.98294
curriculum content desired	910	69 (2-138 even)	0.98788
teaching skills acquired	none surveyed	15 (139-167 odd)	N/A
teaching skills desired	none surveyed	15 (140-168 even)	N/A

The second step of analysis with the major factors: curriculum content acquired, curriculum content desired, teaching skills acquired, and teaching skills desired was to determine if there were any differences among the units of analysis. A One Between-One Within Manova procedure was performed and a significant difference was determined. The data pertaining to this procedure and resultant determinations are contained in Table 4.6 .

The third step of analysis, a Scheffe Procedure for Analysis of Variance, was done to determine among which units of analysis the differences existed, using the averages derived by combining the two variables for curriculum content, as well as combining the two variables for teaching skills.

TABLE 4.6

"One Between - One Within Manova Procedure to Determine Group Differences"

Mean Scores -for Units of Analysis: -for Variables:	students	instructors	program directors or deans	field-related employers
curriculum content acquired	272.1978	277.5764	254.8317	298.8900
curriculum content desired	194.3060	221.2651	230.4356	238.7030
teaching skills acquired	194.3060	30.3804	31.9109	not surveyed
teaching skills desired	25.3769	24.5994	29.0693	not surveyed

f - ratios for multivariate test of equality
(figures over 0.5 indicate significance)

curriculum content acquired versus curriculum content desired	2,962.0701
teaching skills acquired versus teaching skills desired	432.4045

f -ratios for multivariate test of equality across variable groups
(figures over 0.5 indicate significance)

curriculum content acquired plus curriculum content desired	34.7278
teaching skills acquired plus teaching skills desired	165.9625

Data from this procedure is contained in Table 4.7. For the average of the curriculum content variables, field-related employers differed from all other units of analysis (students, instructors, and program directors or deans). Additionally it was shown that students and instructors as groups differed from each other. The average for teaching skills variables dealt only with students, instructors, and program directors or deans as units of analysis; field-related employers were not surveyed for these variables. When this Scheffe Procedure for Analysis of Variance was completed, it showed that the unit of analysis - program directors or deans, differed from both the other units of analysis (students and instructors).

The last step of analysis applied to the variables: curriculum content acquired, curriculum content desired, teaching skills acquired, and teaching skills desired was to determine separate variable, unit of analysis group differences. Table 4.8 illustrates the data compiled as a result of this final procedure of analysis on these variables. When the Scheffe Procedure for Analysis of Variance was applied to curriculum content acquired, it showed that the units of analysis - program directors or deans and field-related employers differed from each other and also from both of the remaining units of analysis, students and instructors. For curriculum content desired, it was

TABLE 4.7

"Scheffe Procedure for Analysis of Variance for Two Combined Variables"

(X denoted pairs of population groups significantly different at the 0.050 level)

Based on a Combined Average for Curriculum Content Acquired and Curriculum Content Desired

Mean	students (1)	instructors (2)	program directors or deans (3)	field-related employers (4)	
463.9536		X		X	(1)
492.4653	X			X	(2)
486.5918				X	(3)
595.5852	X	X	X		(4)

Based on a Combined Average for Teaching Skills Acquired and Teaching Skills Desired

Mean	students (1)	instructors (2)	program directors or deans (3)	
54.7574			X	(1)
56.9774			X	(2)
60.9802	X	X		(3)

demonstrated that the student unit of analysis differed from all the other units of analysis (instructors, deans or program directors, and field-related employers). In addition the instructors and field-related employers' units of analysis differed from each other. From application of the Scheffe Procedure for Analysis of Variance to teaching skills acquired it was shown that none of the units of analysis were significantly different at the 0.050 level. Among the units of analysis (students, instructors, and program directors or deans) surveyed for teaching skills desired, the data reflected that the program directors or deans differed from both the other units of analysis (students and instructors).

TABLE 4.8

"Scheffe Procedure for Analysis of Variance Using Four Variables"

(X denotes pairs of units of analysis significantly different at the 0.050 level)

Based on the variable	Teaching Skills Desired			
	students	instructors	program directors or deans	
Mean	(1)	(2)	(3)	
24.5994			X	(1)
25.3769			X	(2)
29.0693	X	X		(3)

TABLE 4.8 (continued)

Based on the variable Teaching Skills Acquired

NO two groups were significantly different at the 0.050 level among the three groups surveyed for this major factor

Based on the variable Curriculum Content Desired

Mean	students (1)	instructors (2)	program directors or deans (3)	field-related employers (4)	
194.3060		X	X	X	(1)
221.2651	X			X	(2)
230.4356	X				(3)
238.7030	X	X			(4)

Based on the variable Curriculum Content Acquired

Mean	students (1)	instructors (2)	program directors or deans (3)	field-related employers (4)	
272.1978			X	X	(1)
277.5762			X	X	(2)
254.8317	X	X			(3)
298.8899	X	X	X		(4)

(X denotes pairs of units of analysis significantly different at the 0.050 level)

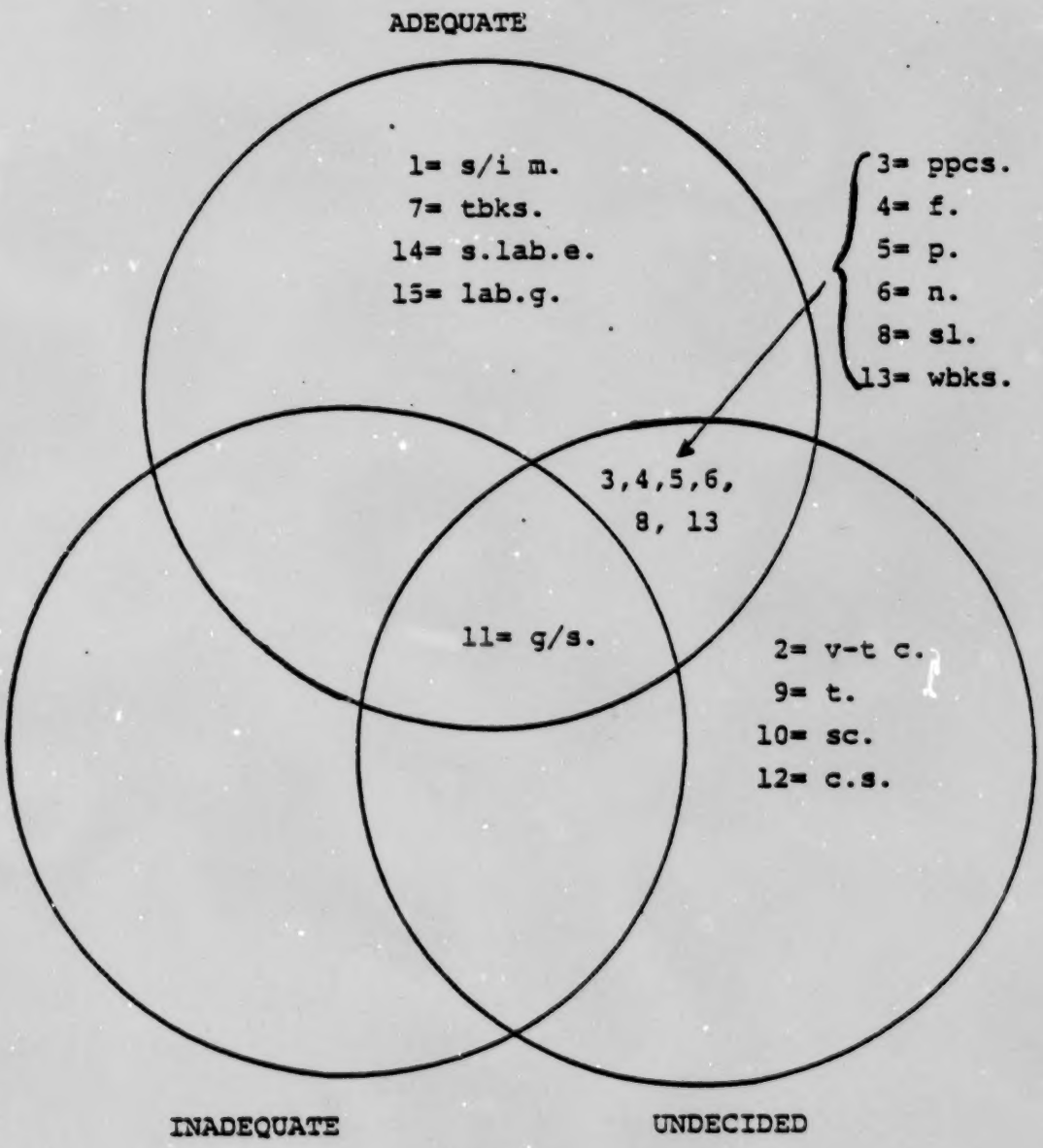
For the variable, materials format type, field-related employers were not surveyed. The other three units of analysis, students, instructors, and deans or program directos, had data on this variable that was compiled separately for each unit of analysis and also a total three-way compilation. In analyzing the raw data in these four segments, responses of thirty percent to forty-nine percent were noted in one manner and responses of fifty percent or more were recorded in another manner. Any response which was marked less than thirty percent of the time in any of the four segments was not noted. (refer to Appendices P, Q, R, and S)

Analysis of students' responses for quality and accessability of materials with regard to material format types showed that the majority of the fifteen listed types were rated 'adequate' and approximately another one-third of the responses were 'undecided', while less than twenty percent of the responses rated the types 'inadequate'. With just one exception, specialized laboratory equipment, the majority of the respondants rated the cost 'about right'. Specialized laboratory equipment was the only one of the fifteen material format types that most of the students considered 'too high' in cost. None of the types was rated between 'average' and 'seldom' ratings for fourteen of the

TABLE 4.9

"A JOINT COMPARISON OF QUALITY RATINGS FOR FORMAT MATERIALS TYPES"

(1 - 15 = format types materials listed in Appendix S)

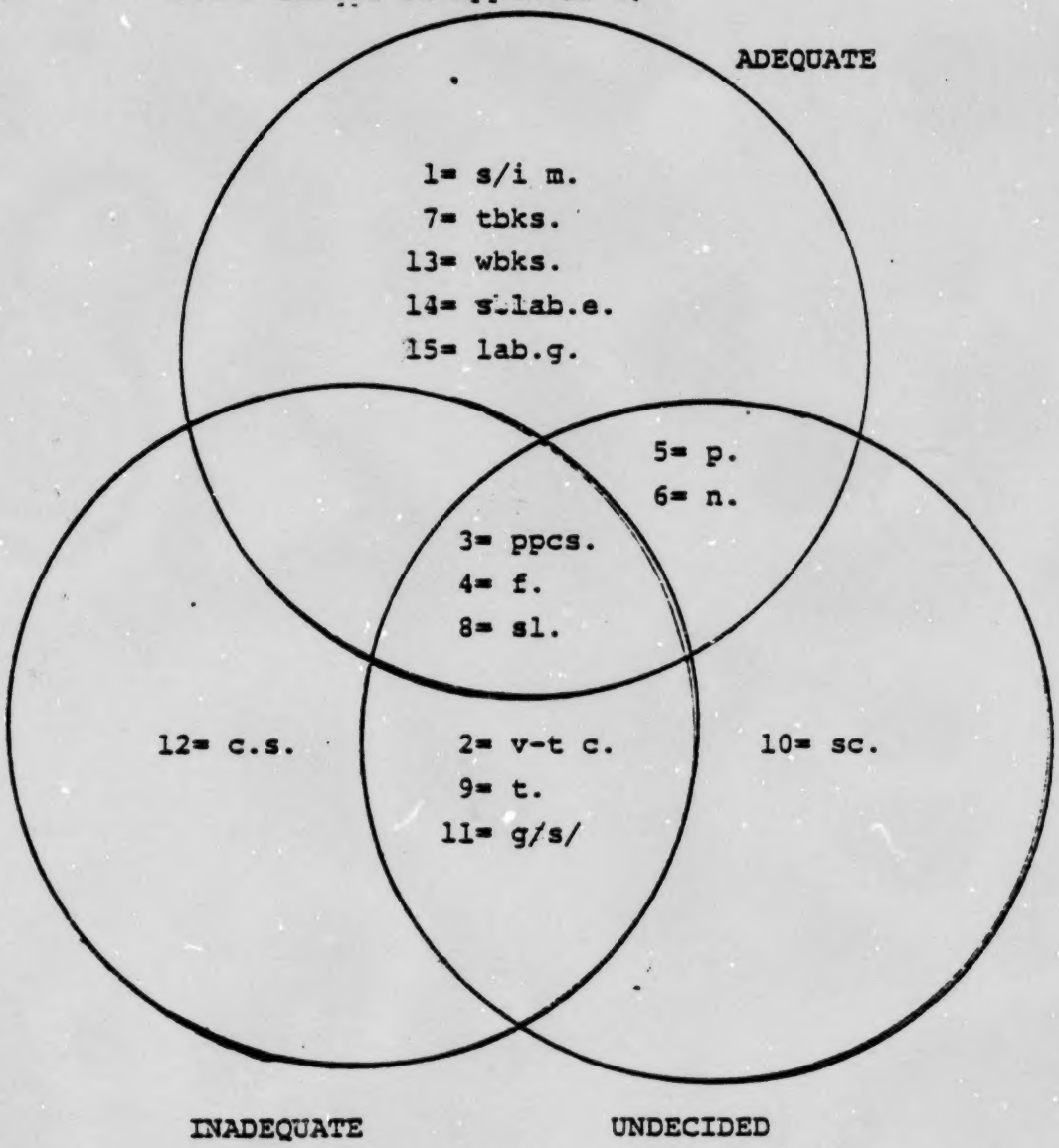


items. The items, textbooks and lab guides, were recorded thirty to forty-nine percent and over fifty percent under past usage, 'often'. Practicality was overwhelmingly considered 'useful' by the students in every category except scripts, where the rating was 'undecided'. When asked "Should the material be produced in this area?", the vast majority of the student respondents marked 'definitely'. The two items where response was 'undecided' for this question were scripts and computer simulations. Analyzing the instructors' responses to the same question indicated the response 'definitely' for nearly all the items. The three 'undecided' items according to instructors were scripts, games/simulations, and computer simulations. This reflects closely the responses given by the unit of analysis - students. However, the comparison of responses for practicality, past usage, cost, accessibility of materials, and quality did not demonstrate so close a degree of similarity. The majority of the instructors indicated they were 'undecided' about the quality of format material types. None of the items was rated 'inadequate' by the instructors in terms of quality, but only two items, were rated 'adequate' by the majority of the instructors. These items were manuals and specialized laboratory equipment. Three more items however were rated 'adequate' by more than thirty percent of the instructors.

TABLE 4.10

"A JOINT COMPARISON OF ACCESSIBILITY OF MATERIALS RATINGS FOR FORMAT MATERIAL TYPES"

(1 - 15 = items listed in Appendix S)



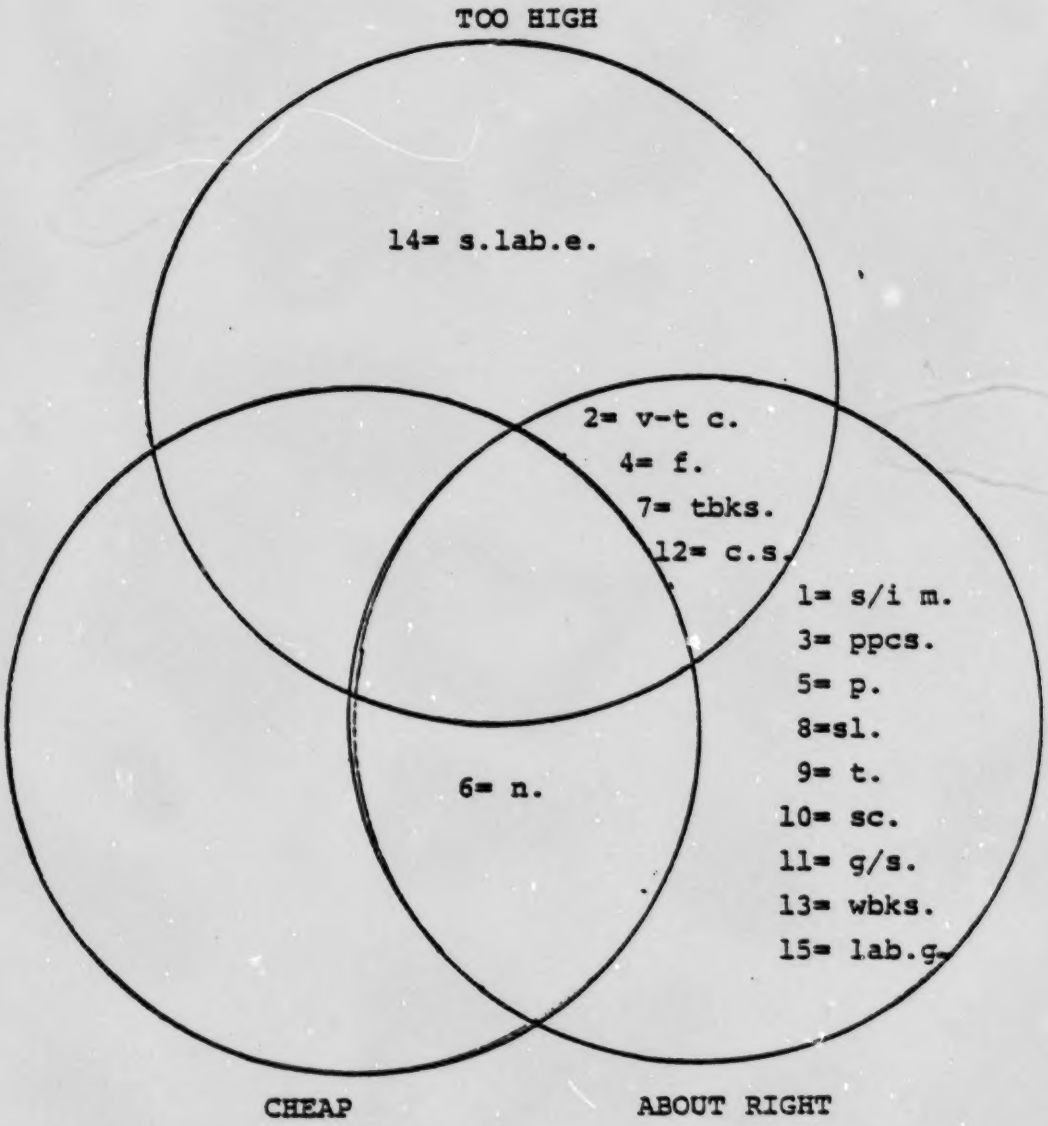
To identify these specific items refer to Appendix Q. The overall responses of the instructors regarding the accessibility of materials split on a 2:1:1::'adequate': 'undecided':'inadequate'. Even though most of the items were rated 'adequate' by the majority of the instructors, the fact that the majority of theinstructors also rated nearly twenty-five percent of the items 'inadequate' in terms of accessibility requires additional research attention. The majority of the items were rated 'about right' for cost by the instructors, the majority of the time. Again, interestingly however, a majority of the instructors rated better than one-third of the items 'too high' in cost, and only newsletters were rated 'too cheap'. Manuals, lab guides, specialized laboratory equipment, textbooks and slides were items marked 'often' for past usage by the majority of the instructors. The majority of the instructors rated 16mm films, pamphlets, and workbooks as 'average' for past usage. Seven other items were rated 'seldom' for past usage by the majority of the instructors. In terms of practicality, none of the ratings showed any of the format material types to be considered 'not useable' by the instructors. In fact, most of the instructors rated nearly two-third of the items 'useful'. Only five items were rated 'undecided' by the majority of the instructors for practicality.

The responses of the program directors or deans

TABLE 4.11

"A JOINT COMPARISON OF COST RATINGS FOR FORMAT MATERIAL TYPES"

(1 - 15 = format type items listed in Appendix S)

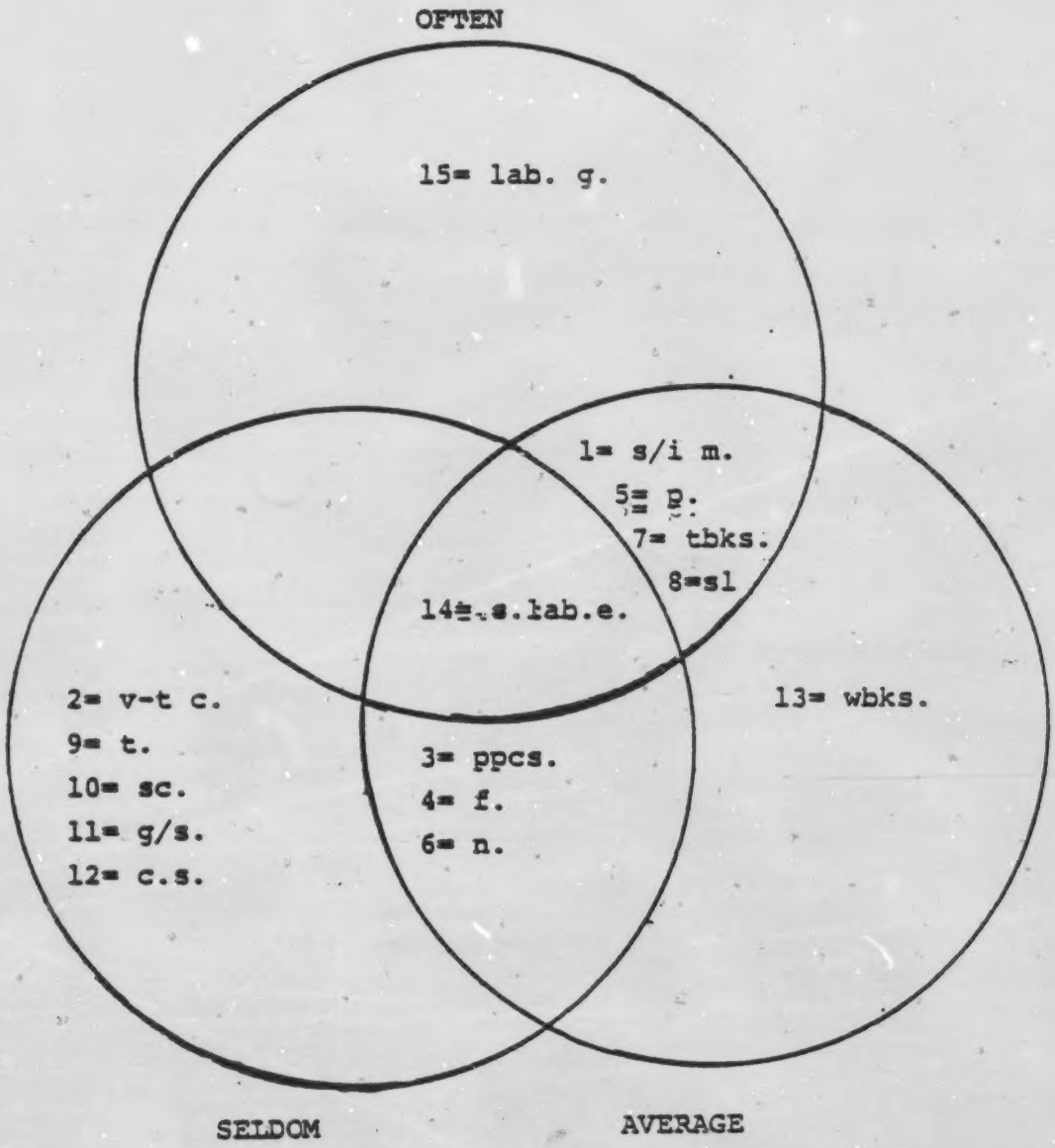


indicated majority responses which varied somewhat from both the student unit of analysis group and the instructor unit of analysis group. In conjunction with the instructors, the program directors or deans rated none of the items 'inadequate' in terms of quality for format materail types. About one-third of the items were rated 'undecided' by the majority of the program directors or deans for quality. This left two-third of theitems rated 'adequate' for their quality. One-half of the items were rated 'adequate' in terms of accessibility of materials by the majority of the program directors or deans. Only two items were rated 'inadequate' by the majority of the program directors or deans for accessibility of materials, however these items included textbooks and computer simulations. In addition thirty to forty-nine percent of the program directors or deans rated programmed and packaged course of study 'inadequate' for accessibility of materials, and for one-third of the items the majority of the program directors or deans were 'undecided' concerning accessibility of materials. The program directors or deans as a unit of analysis differed over the specific items which they considered 'too high' in cost, but the program directors or deans rated nearly one-third of the format material type items 'too high' in cost. Generally the program directors or deans rated cost for the items 'about right'. Only pamphlets

TABLE 4.12

"A JOINT COMPARISON OF PAST USAGE RATINGS FOR FORMAT MATERIAL TYPES"

(1 - 15 = format type items listed in Appendix S)

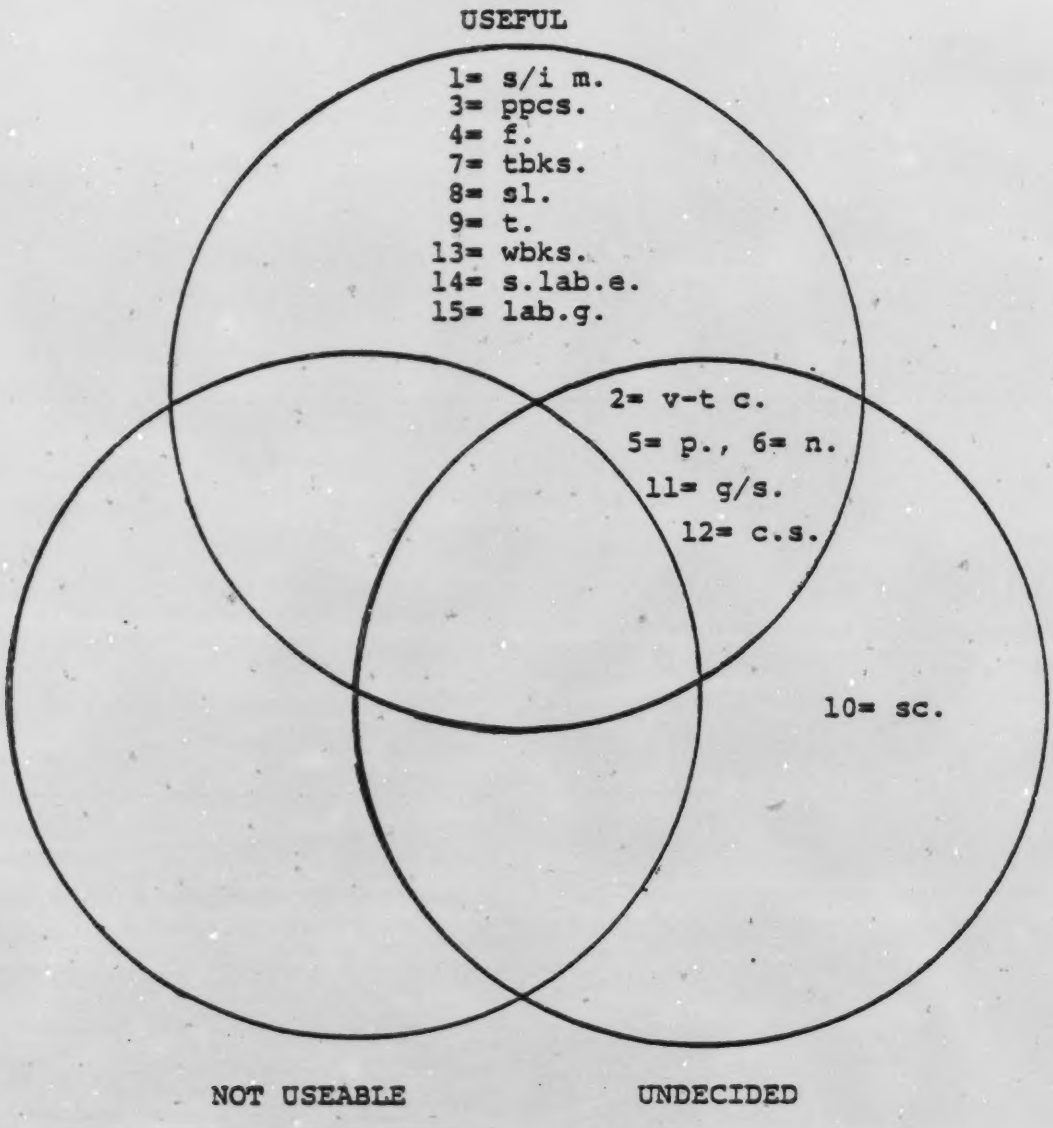


were rated 'too cheap' in cost by the majority of the deans or program directors. Thirty to forty-nine of the deans or program directors also rated slides and textbooks 'too cheap' in cost. However it should be noted here that the program directors or deans split fairly evenly among the choices 'too high', 'about right', 'too cheap' for both of these items. Ratings for past usage by the program directors or deans split nearly equally between 'often' and 'average' for the majority of the responses and items. Only scripts and computer simulations were rated by the majority of the program directors or deans as past usage 'seldom'. Two items were also rated by the majority of the program directors or deans as 'not useable' for practicality. They were video tape cassettes and pamphlets. These item responses warrent further consideration. Additionally, seven items were rated 'undecided' by either thirty to forty-nine percent of the program directos or deans or by a majority of them. This left six items the deans or program directors rated 'useful' a majority of the time, and two more items rated 'useful' by thirty to forty-nine percent of the program directors or deans. Overwhelmingly, the program directors or deans responded 'definitely' to the production of materials, with none of the items rated 'definitely not' by even thirty percent of the program directors or deans. The following items of pamphlets, newsletters, and

TABLE 4.13

"A JOINT COMPARISON OF PRACTICALITY RATINGS FOR FORMAT TYPE MATERIALS"

(1 - 15 = format type items listed in Appendix S)



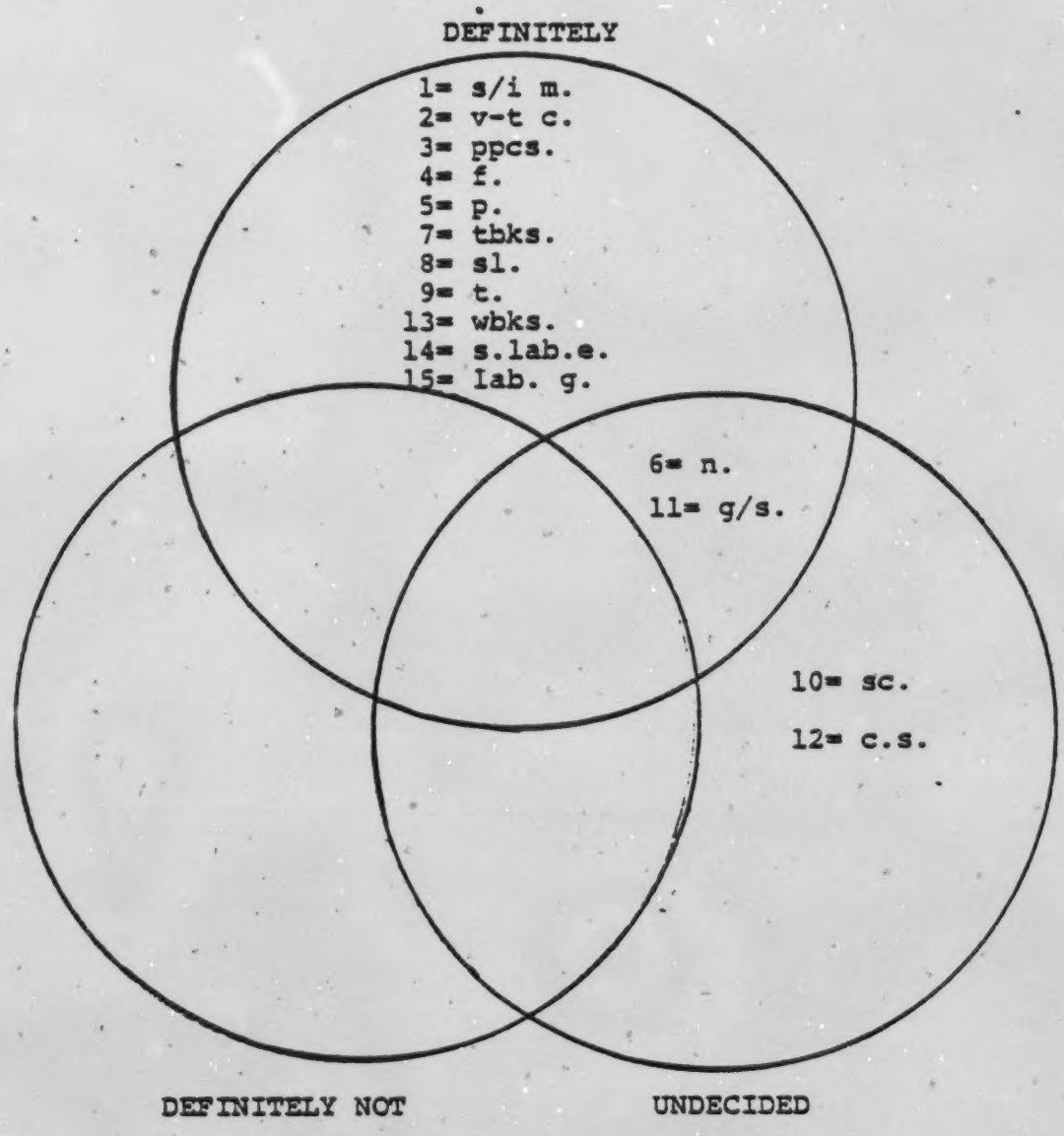
scripts were three items the majority of the deans or program directors marked 'undecided' in answer to the question, "Should material be produced in this area?" Refer to Appendix R for the exact charting of these percentage responses and specific item listings.

Appendix S contains the compiled data for all three units of analysis. It indicates the two percentage categories for the fifteen format materail types as they figured in total for the ratings on quality, cost, past usage, accessibility of materials, practicality, and production of materials. Both practicality and the production of materials received ratings by the majority of all the units of analysis that were positive, and none of the percentage ratings were recorded as 'not useable' or 'definitely not'. A few of the items were rated 'undecided' for both practicality and the production of materials, by either thirty to forty-nine percent or a majority of the respondants. In terms of cost, only newsletters were marked by the majority of the respondants as 'cheap'. Mainly the ratings were 'about right' for the majority of the respondants, and only 16mm films and specialized laboratory equipment was rated 'too high' by this majority. Video-tape cassettes and textbooks were also rated 'too high' by thirty to forty-nine percent of the respondants. In terms of quality, only one item, games/simulations was rated in a

TABLE 4.14

"A JOINT COMPARISON OF 'SHOULD MATERIAL BE PRODUCED IN THIS AREA?' FOR FORMAT TYPE MATERIALS"

(1 - 15 = format type items listed in Appendix S)



three way split among 'adequate, 'undecided' and 'inadequate'. None of the other format material type items were recorded as 'inadequate' by any noted percent. The respondants were nearly equally split between 'adequate' and 'undecided' with regard to quality for format material types. Though seven items were recorded as 'inadequate' for accessibility of materials, only one of those items, computer simulations was so rated by a majority. For one-third of the items, the majority of the respondants rated accessibility of materials 'adequate', and for scripts the majority rating was 'undecided'. Generally the ratings for accessibility of materials showed a wide range of opinion with several three way splits on the percent ratings. Lab guides was the only item which the majority of respondants rated 'often' for past usage. One other item was rated 'average' by this same percent, workbooks. One-third of the items were marked 'seldom' for past usage by this majority and four more items were so rated by thirty to forty-nine percent of the respondants. These facts warrant further attention and treatment which is most appropriately reserved for chapter V.

The last topical area, attitude assessment, was analyzed in accordance with directives in the Purdue Master Attitude Scale. For the students' unit of analysis the average attitude scale value was 8.9. The average

attitude scale value for instructors' unit of analysis was 5.5. The program directors' or deans' unit of analysis resulted in a 5.5 value. A value of 3.6 was the average for the field-related employers' unit of analysis. The value 6.0 is rated equal to indifference in this scale. Values over 6.0 show a favorable attitude and values less than 6.0 reflect an unfavorable attitude. With regard to the four units of analysis of this study, it showed one favorable attitude (students), two nearly neutral or indifferent attitudes (instructors and program directors or deans), and one unfavorable attitude (field-related employers). Conclusions drawn from these values are reserved for Chapter V.

TABLE 4.15

"Average Attitude Assessment Values by Unit of Analysis"

unit of analysis	average value	
students	8.9	(less than 6.0 = unfavorable, 6.0 = break even, more than 6.0 = favorable)
instructors	5.5	
program directors or deans	5.5	
field-related employers	3.6	

Workshop Data

This information is taken from a preliminary review of the summer, 1977 workshop which I co-authored with Thaddeus Fowler, Ed. D. The workshop was held at the National Training and Operational Technology Center in Cincinnati, Ohio for one work week. The workshop was designed and executed as a cooperative effort between the University of Cincinnati, College of Education and the Environmental Protection Agency. Twenty-six participants were chosen from nominations submitted by Regional Workforce Officers from each of the ten EPA regions. These participants represented two-year technical institutes and colleges, four-year colleges, graduate programs, as well as state and regional program directors.

The workshop was developed in recognition of the increased need for technicians, operators, and engineers with training in the area of water pollution control. Information was presented during the workshop which would help educators in the area of water pollution control to train the needed specialists. It is the task of these specialists to design, operate, manage, and monitor the various pollution control facilities and systems which are currently in existence and which will drastically increase in number as new water pollution control guidelines are

put into effect. In order to improve the availability to meet these demands it will be necessary to strengthen water pollution control training centers at educational institutions (colleges, universities, community colleges, etc.) across the country. The intent of the workshop was to acquaint a portion of the educational community with the need that exists for water pollution control personnel and with the availability of Agency training programs and training resources. Through this effort it was hoped that the National Training and Operational Technology Center and the educational community might begin to be strengthened. Training programs around the country could be improved and new programs initiated, Hopefully, through such efforts, the states will become self-sufficient in water pollution control training efforts.

During the five-day training workshop several areas of topical information were stressed, including information about training courses and other training resources available from EPA. It was to be expected that as a result of the workshop: (1) participants would become familiar with Agency sponsored programs or courses in water pollution control; (2) the need for water pollution control training programs across the country would be made more apparent; (3) necessary impetus to strengthen these programs would be provided; (4) informal lines of communication would be

encouraged among educational training institutions and between these institutions and the Environmental Protection Agency; and (5) the principles of program design and management would become better understood.

Twenty-three presenters were recruited to share their expertise with the participants. Descriptions of ongoing programs were given, Agency developed educational materials were presented and sampled by the participants, the Instructional Resource Information System (IRIS) described and utilized, and specific teaching techniques were detailed. In addition updating sessions were held to inform the participants of the current status of certification requirements and of how to stay aware of the latest developments. Built into the workshop schedule were several sessions where the participants and presenters could informally discuss programs, share ideas, and generally become aware of each other's roles and concerns. Also, meals and housing were arranged to allow further contact and communication.

A special effort was made to solicite feedback from each of the participants. Data was received about the management of the workshop and the information presented. In addition the participants gave their perspectives of the existing relationship between the Agency and educational institutions. Suggestions for strengthening this relationship and specific recommendations for types and formats

of needed educational materials were made.

The feedback collected during the workshop from the participants on the sessions indicated strong interest in Agency materials and programs. The fact that individual interest centered on specific presentations which were most pertinent to their own particular programs appeared quite significant. This was evidenced for example by the two year people who were almost solely interested in hearing about two-year programs while four-year people were interested in four-year program information. They had a particular interest in interacting with professors and instructors with similar backgrounds from the various geographical regions. The participants gave positve feedback on each program applicable to their area. In general the participants found the programs and materials presented mostly interesting and of some considerable value. They were especially interested in: how they could obtain copies of new teaching materials, how much it would cost for implementation, availability of financial aid, and what consulting assistance might be available.

Participants were concerned about better communication and knowing what their colleagues were doing in the water pollution control training field. They also wanted to find out more about: obtaining information on new programs and materials; determining the availability of these programs

amd materials; checking evaluations and reviews of new programs and materials; how and where instructors can be trained to use such programs and materials; general functionality of trainees; and the longevity of their graduates in their job classifications. A universal concern cited by the participants centered on the need to establish a clearing house to deal with the previously mentioned problems. With little exception, the participants noted that the presentations were well done and interesting. Other comments reflected various degrees of involvement with presentations, apparently based on personal opinions. It was generally held that the sessions were enjoyable and that participants would have liked to have had more time allotted to several sessions. An extension of the sessions would have allowed for better familiarization with programs and materials through an approach involving even more direct contact for the participants with the actual materials. Additionally, more time in each session might have been beneficially allotted for interchange among the various participants as well as with the session presenter.

In considering what the role of the EPA ought to be in water pollution ocntrol training field, many aspects of possible direction and assistance to training institutions were enumerated by the participants. These aspects varied from participant to participant in their priority ranking

depending on the nature of their individual training programs. The EPA should continue its development of a cataloging system for materials and programs. However, this system needs to critically evaluate entries and provide information on current availability of the listed materials. It was generally felt that the EPA should continue production of prototype instructional materials and that the materials produced so far were of value. Media materials would be of particular value in the format of 35mm slides and 16mm films. Videotape cassettes are at present of little utilitarian value because of a lack of videotape playback equipment.

Additionally, the Agency is looked to for guidance and coordination of water pollution control training activities and environmental education activities in general. The participants would like to see increased efforts in the dissemination of information and materials defining goals and objectives, and in defining qualitative requirements for educational programs. The Agency should involve itself in increasing communications among governmental institutions, educational institutions, and public interest groups. Possibly, a newsletter of some form could be instituted. Finally, the EPA might help in the organization of the printing and overseeing the marketing of educational materials.

Overall, the participants expressed genuine interest in and appreciation for the workshop. From casual observation, they seemed to benefit tremendously from the contact with their colleagues and with the presenters. Most, if not all, verbally expressed the ways in which they would implement the information and methods presented during the workshop. The idea of having similar workshops presented at a regional or state level was expressed. Formal evaluation and following activities were designed to validate these observations and to further pursue and define the possible future EPA educational activities.

On-Site Conferences Data

This data is a compilation in summarized form of the questions and answers which were exchanged in discussions between myself and various program directors or deans as well as some instructors and students during visitations across the continental United States. Appendix J contains a listing of the formalized interview questions from which I based the flow of conversation which was recorded in cassette form. Through additional informal discussions and observations it was possible to place the information in general context and perspective upon compilation.

Nearly, all of those who were formally interviewed, if

not all, stated that they had benefited from the trip and time spent in Cincinnati. The amount they felt they benefited ranged from simple direct contacts established through a great deal of information valuable to their programs. This included familiarization with materials offered, ways of getting materials, activity involvement of the USEPA Cincinnati in the field to a more full extent, as well as direct contact with colleagues from other geographic locations plus those in Cincinnati. Due to the diversity of information and backgrounds of those who attended some of the things seen were not of value to individual programs, and some of those interviewed felt they were swamped with too great an abundance of materials in a practical sense during a single work week.

General but incomplete awareness of the USEPA's activities and involvement in the field from Cincinnati seemed to be the general knowledge level. This partial awareness was mainly from contact with bulletins received at their home locations. Most interviewees cited the value of the free loan materials available to them from Cincinnati, however specific use made of these materials following the workshop participation covered a wide range of number and degree of material usage. Expanded focus on IRIS seemed to have increased use of items from this system. Many of those interviewed remarked on the large

number of audio-visual materials that improved their programs.

When asked to select the most suitable audio-visual format material type the general optimum choices were 16 mm films or slide/tape packages. Although video cassettes were very appealing, two general drawbacks were noted about them. First, many places simply do not have the accessibility to video playback equipment or it requires an undue effort on their part to obtain such equipment for use. Secondly, the problem of small screen viewing by large classes was viewed as too great an obstacle to the package appeal and attention focusing advantages. Many felt the production methods achieved a very good level of quality. With regard to content of materials the consensus agreed that newer items were getting better. The difficulty with older materials did not seem to even be so much directed at content but more toward perceived poor presentation methods.

Many of those interviewed had previous knowledge of IRIS and a large number had used the system. General impressions of the system were that it could be very helpful. Items available were of good quality and easily obtainable. It was noted that because of the newness of the system certain difficulties had to be expected, despite the inconvenience this caused any users. Some of the

difficulties mentioned included items which were not as they were described in the catalogue and further that some of the choices were not in fact avaliable as they were no longer being published. Most of the disappointment with the system reflected to these difficulties.

Given the authority to control USEPA funds for training the majority opinion was to spend the monies for direct training by expanding facilities for handling larger numbers of students as well as improving the facilities themselves at various locations in regions across the country. Some additional purchasing of audio-visual materials and publication replacement was also generally cited. Most packages, even those items produced by "top-notch" places were not viewed as matching in output the expense which had gone into them. These less than expected results were noted both in terms of quantity and quality which consequently has placed many items on the shelf in Cincinnati for too limited a usage possibility, if at all. The main suggested solution to this problem was to place the money use into "new" hands or more direct regional facility upgrading, including the purchase of mobile units for in the field training. There was also general agreement that programmed instruction needed to be more thoroughly developed but that entire funding should not be solely directed to that type

production. Some cited the value of programmed instruction for home study stipulating however that alone it really was not totally sufficient. Others commented on the time saving aspect of programmed instruction for formal training in the basics, which could then be followed with other methods for more advanced training especially in operation and maintenance.

Almost everyone thought some form of educational plan and model in the form of national certification would be an improvement. The uniformity of course objectives which would be more widespread as a result of such certification requirement seemed to be a good point with most of those interviewed. The difficulties which are encountered even with reciprocal licensing agreements between states could then be overcome. The interviews seemed to favor specific certification as a more plausible form than general certification. The possibility for implementing any such national certification program was mainly viewed as encompassing no greater variety of treatments than is already covered by state certification programs. Some separation of worker classification jobs from operator classification jobs was remarked upon, the former requiring no certification and the later requiring it most likely in varying grades or levels of certification. Operators associations were generally thought to be in favor of

such certification. However it was also remarked that unions, big lobbyists and industry could be expected to fight such certification implementation. For the most part educational institutions already have established standards which would exceed probable minimums which would be incorporated into any national certification scheme.

Current requirements for various types of certification range from simply passing a written test, to a minimum education background and one year provisional experience with a licensed person prior to certification, followed by additional education and experience requirements to upgrade the level of certification. Retraining programs appear to be limited in scope, time, and cost to make them attractive enough to draw full enrollments. Such programs also seem to be a small portion of the educational institutions' programs. Ten years ago stigma seemed to have been a problem in the view of many of those interviewed, but during the last couple years that stigma has apparently evaporated.

Students obtained their on the job training in a couple ways. One was to be placed by the institution in a nearby facility without compensation, or for the student to contact a facility and then have the training institution follow the contact with the necessary paper work. Some

educational institutions have equipment which can be used by students in logging experience time. The length of formal training varies depending upon the institution, including two semester courses, two-year associate degree programs, as well as four-year degree programs.

Fees for training and other costs totaled at least $1500 per year for tuition, room and board, and books. Some institutions loan books for use by students who have an option to buy those that they wish to keep. While a large range of ages for students was noted, the current average was approximately twenty-nine and dropping as time proceeds. Entry level salaries were generally cited around $9,000.

There was minimal evidence of follow-up assessment of trained students to ascertain if their job performance was better than untrained personnel and resulted in improved plant operation. Feedback noted was mostly informal favorable comments, plant superintendents notifying institutions of job openings and state department officials encouraging attendance at an educational institution. Mainly there seemed to be a lack of personnel and funding for such assessments.

Qualifications for instructors though substantial in the minds of nearly all those interviewed were not necessarily prerequisite to hiring. The most commonly

mentioned qualifications included: experience in some type of treatment plant, certification by local or state authority having jurisdiction over the educational institution, balancing the content knowledge of the staff as an entity to balance individual areas of specialized knowledge, and lastly teaching training and/or experience. In most of the locations teaching training or experience was considered a plus but generally waived in favor of content knowledge. Finding and keeping a qualified staff of instructors was considered a difficult problem. The most notable qualification gap was in the teaching methods knowledge or experience. Training to improve such knowledge or experience was noted as difficult to obtain in short course form which would fit the time such instructors have available, whether a week during the school year or a summer course. Presently some manufacturers sponsor such courses, however most teaching methods courses involve one to four years training time. Mainly it was stated that instructor training possibilities remain very limited. Workshops such as those held in Cincinnati were noted by many as ideal with the stipulation that the location be mobile for access to instructors everywhere without necessitating expensive travel to Cincinnati. Most were hasty to add that this however should not preclude the continuation of the workshop

offering in Cincinnati, but rather that it should be replicated "on the road". Due to the regulatory action of the USEPA and their enforcement of rules, a large number of those interviewed thought such instructor training might better be handled by some other institution. Many instructors mentioned their interest in obtaining such training to bolster presentation of content knowledge they need to transmit to students. Part of the high turn-over rate among instructors was tied to low salaries in the range of $13,000 to $18,000 per year, which made private industry offers nearly impossible for quite a few to refuse.

Almost without exception, the educational training programs were not cost efficient, and received support from various forms of outside funding.

Textbook materials were another area of difficulty for most of the programs and people interviewed. Appropriate textbooks were cited as next to impossible to locate and many incorporate various portions of manuals into a form of self-made textbook. For subjects related to wastewater, including biology and mathematics most notably, finding books which relate to training is extremely hard. Those textbooks which do exist were remarked upon as very thorough in treatment of theory by those interviewed. The treatment of practical maintenance however was agreed by

many to generally be lacking in print.

Curriculum input authority varied almost equally with the number of conferences and locations visited. Some curriculum input comes almost entirely from consultations with chief operators of plants. Other curriculum input comes from manufacturers. More cited a multiple source of curriculum input covering training people in nearby states, field-related state department officials, and survey comments and suggestions from past students. Based on this type of committee curriculum input, many program directors or deans stated they felt they had a strong base for recommending curriculum changes to higher administrative authority who could initiate such changes. Though limited, the retraining aspect of such curricula were said to be received with enthusiasm by operators and maintenance employees enrolled for retraining. The hands on experience of such training and specialized aspects of retraining were seen to be successful on the limited basis they are offered because of incentive from city council plant funding incentives and self realization and desire for advancement. For some maintenance people this retraining gain knowledge of equipment in relation to wastewater, since many enter the field from automotive companies and other manufacturing job backgrounds. Many of those interviewed commented on the fact that most of the curriculum focus centers on entry level training education. Perhaps expanded training

efforts could be one area in this field which future training growth will require greater attention. Comments on the future incorporation of computer technology as a growing aspect to be included in education training varied based upon the number of plant facilities in the nearby localities equipped with computerized machinery. Additonally comments were cited that equipment repair training among students entering the field will be increasingly necessary to avoid high service call costs to wastewater plants from manufacturers. The future need for "on the road" workshops to improve instructors' teaching methods skills was remarked upon in several interviews as necessary since many education institutions cannot afford the spiraling costs of sending instructors to any one far removed location. Closing comments in several interviews emphasized that formal training was not book and classroom limited, and that as much as twenty percent of the educational experience of students was with direct observation and viewing reports. The need to continue heading generally in the same direction was emphasized, but with the additional remarks on the possibility that regional plants could more economically and more efficiently handle wastewater treatment if smaller political boundary difficulties could be circumvented.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This chapter contains a summary, a listing of the conclusions drawn from the analysis of the data, a delineation of possible implications of the data, recommendations for program action, and ideas for future research.

The primary objective of this study was to determine the needs of effective and viable environmental control education program for instructional personnel, and what the role of the USEPA, as the official Federal government agency dealing with the environment, ought to have in such training. The main thrust was to obtain the instructional needs which the four surveyed units of analysis (students, instructors, deans or program directors, and field-related employers) perceived would be important in the development of refined education/training objectives in the field of water pollution control training, using accessible, quality, appropriate, updated materials and properly

educated instructors to train personnel in this field. In addition to the surveying, data from "Water Quality Instructors' Workshops" and interviews at educational institution conference visitations completed the information gathering for presentation, analysis, conclusions, and recommendations.

The oral interviewing and survey methods of research technique necessitated the construction and validation of questions and questionnaires developed and revised through guidance from college level educators. Further, an exploration survey was made and data collected from workshops pertinent to this study topic. A review of the related literature was conducted and the findings were reported.

The questionnaires were distributed to a total population of 3,000, which included 800 students, too instructors, 200 program directors or deans, and 1,500 field-related employers. Members of each unit of analysis were identified through nationwide public telephone directories, Ohio and other state manufacturing association mailing lists, government publications in addition to those from USEPA and NTOTC, plus educational institutions with divisions and departments directly involved with water pollution control training. In final tabulation, there were 1,957 (67.1 percent) usable questionnaires returned. The responses were statistically treated in a four part

analysis. Reliability scores were computed over four variables (curriculum content acquired, curriculum content desired, teaching skills acquired, and teaching skills desired) followed by a One Between-One Within Manova to determine group differences among the units of analysis. Next, Scheffe Procedures for Analysis of Variance were applied to determine among which units of analysis the differences occurred. The format materials types portion of the surveys was analyzed with the use of frequency tables to compile percentage scores. Attitude assessment, the final portion of the survey was scored according to indicated procedures in the Purdue Master Attitude Scales. Data collected from the workshops pertained to the presentation of information which would help educators in the area of water pollution control to train the needed operators and other specialists. Evaluation data on these presentations completed this portion of data collection. The information acquired through oral interviews with various program directors or deans as well as some instructors and students during visitations to educational institutions completed the aggregation of data for this study.

Conclusions

The conclusions are inherent through the answers to the five questions stated in the Purpose of the Study in Chapter I.

"1. Should the USEPA help educators run training programs?"

Yes, data results collected through the surveying, workshop feedback, and compilation of on-site interview responses, as well as historically documented precedent, all support Agency aid and assistance to educators running training programs in water pollution control. Further facts in this study show that nearly all training programs in this field do not meet their expenses without additional aid. In the review of literature on page forty-five of this study it was noted that budgetary cuts and their resultant limitations on options for Agency achievement of training objectives have had significant impact, beginning in 1977. This study shows that funding aid for training programs should be increased by the government. If funding is more proportionately balanced for training programs with the existent construction grants in this field and controlled by the Agency through minimum requirements greater strides will be possible in the abatement of water pollution. Agency involvement also needs to establish a clearing house to aid educators in obtaining information on new programs and materials, for determining the availability of these programs and materials, to check evaluations and reviews of new programs and materials as well as how and where educators can be trained to use such programs and materials.

"2. Should the USEPA provide curriculum materials and in what form?"

Yes, the study supports curriculum materials being produced and provided by the Agency. Expanded data supporting this answer from the review of the literature, surveys, workshop feedback, and interviewee responses is cited under point three in discussion of the data which immediately follows in this chapter. Point five in the discussion of the data details reasons video-tape cassettes are not a practical form for the Agency curriculum materials. In the recommendations section of this chapter, under point four, expanded information regarding form of curriculum materials is listed in treatment of information and analysis of data concerning fifteen specific format materials types.

"3. What should be the nature of instructional assistance provided by the USEPA?"

A definite need for more effective teaching methods information and training for instructors of water pollution control personnel is supported throughout this study, and emphasized under point one of the discussion of the data. Achievement of this objective through establishment of a national instructors training center operated by the NTOTC of the Agency in conjunction with a major university or college of education is emphasized in point three of the recommendations in this chapter. The continued production of curriculum materials by the Agency is an important aspect

of instructional assistance fully detailed under answer two of these conclusions. Maintenance of a clearing house by the Agency on programs and materials would improve accessibility for educators in this field and is shown in point four of discussion of the data in summary from the body of the study.

"4. How much financing responsibility should be assumed by the Agency and government?"

Financing responsibility though partially treated in answer one of these conclusions is essential support to all aspects of training program aid or instructional assistance. As first reported on page forty-five of this study, budgetary cuts and their resultant limitations on options for Agency achievement of training objectives have had significant impact, beginning in 1977. This combined with the lack of multi-discipline co-ordination of the Agency's offices has had the effect of preventing fund transfers, as cited first on page fifty-four of this study. Further cost complexities dealing with government funding are detailed in the review of literature on page fifty-three of this study. The most plausible financing responsibility supported by information in this study is to provide increased monies in the government budget for adequate training of the workforce in water pollution control to keep pace with the building grant funding which has been and continues to be appropriated. This

is further supported by information presented in points six, two, and one of the recommendations in this chapter.

"5. Are there areas of present Agency training programs that should be deleted or revised?"

The analysis of data collected for this study generally supports the continuation of programs and materials related to training in this field by the Agency. Some revisions mainly focusing on expansion and quality control as well as improving accessibility to educators of programs and materials however are cited. Point four in discussion of the data expands more specifically on what such revisions ought to involve. Additionally, several points of the recommendations emphasize improved accessibility, quality control, and expansion of Agency activity in training programs. First, the institution of a mandatory national certification program for those in the field of water pollution control, administered by the NTOTC of the Agency. Second, budgeted, increased funding must be based on at least minimum compliance with Agency requirements and administration. Third, the establishment of a national instructors training center, not solely controlled by the Agency, but rather operated in co-operation with a major university or college of education. Finally, the improved production and dissemination of quality training materials through establishment of a clearing house on programs and materials under the NTOTC of the Agency.

Facts and information which expands on these answers and relates them in more detailed discussion to each other are contained in the discussion of the data and recommendations sections of this chapter. These sections highlight the information obtained through data collection and analysis in this study. The information is concisely summarized from the initial four chapters between these five answers and the discussion of the data plus recommendations in this final chapter of the study.

Discussion of the Data

The following discussions are based on the information presented in the review of literature plus the presentation and analysis of the data. The intactness of curriculum content acquired, and curriculum content desired as variables for each of the units of analysis--students, instructors, program directors or deans, and field-related employers was confirmed from the facts shown in Tables 4.2, 4.3, 4.4, and 4.5, by alpha-coefficients well above the required 0.5 value in each instance. Additionally, the variables teaching skills acquired and teaching skills desired were confirmed for intactness as variables for the three units of analysis so surveyed (students, instructors, and program directors or deans) with similarly high alpha-coefficient values. Though the number of cases surveyed differed for each unit of

analysis, the items among the variables were determined to be properly treated as four variables for the units of analysis--students, instructors, and program directors or deans, and two variables for the unit of analysis, field-related employers. The One Between-One Within Manova simply proved that differences for these variables existed among the units of analysis. This was shown to be considered significant based on the figures given in Table 4.6. Most important are the implications derived from the results of the Scheffe Procedures for Analysis of Variance. When the curriculum content variables were considered in combination, the data indicated that field-related employers differed from all other units of anlaysis for the survey. In addition, a differnce was shown between the units of analysis--students and instructors. This implies that the hiring population in this field are not getting people as they desire or with what they perceive to be necessary background education for employment. In differing from the other three units of analysis, it seems to show the need for the establishment of some common curriculum that will meet the needs of all four populations surveyed through the four units of analysis in this field. The differnece between students and instructors may be a result of instructors needing more teaching experience or knowledge of teaching methods. It might also simply be that the students have a group of needs in mind

which though theoretically logical for their chosen field, may fall short in application, an area for which the instructors in this field have good content knowledge and background experience awareness. The combination of the teaching skills variables showed that program directors or deans differed from both the other surveyed units of analysis--students and instructors. The point which this brings to focus is that the administrative view of education follows an educationally sound path for both content and teaching methods; one or both of which may not be adequate among the students or instructors. Another possibility is that the program directors or deans have lacked direct contact with the situation to be conscious of what is actually possible in practice under current circumstances. Most likely a mixture of these considerations exists as the causes of differing opinions among these four groups. The main emphasis must be the lack of congruence among the populations concerning what should be and what is, as shaded by the background experience of each of these populations. When the variables were separated the differences regarding curriculum content acquired showed that program directors or deans and field-related employers differed from each other as well as from students and instructors. This reinforces the implications stated for the earlier differences and underscores the divergence

of opinion among the four populations with emphasis on variously perceived theoretical and practical backgrounds. With regard to curriculum content desired, students differed from all three others, plus the instructors differed from the field-related employers. The additional implication here seems to be that the past experience of the instructors is not sufficiently abreast to the current field requirements. For teaching skills acquired, there were no significant differences, yet for teaching skills desired, the program directors or deans differed once again from the students and instructors, further emphasizing the polarization of perceived needs. The Venn diagrams in Tables 4.9 through 4.14 deal with comparison of fifteen format materials types rated by students, instructors, and program directors or deans on quality, accessability, cost, past usage, practicality, and the question, "Should Material Be Produced in This Area?". These particular tables and the Appendices P, Q, R, and S which detail the separate population ratings as well as the composite for students, instructors and program directors or deans in instances of more specific detail emphasize the lack of congruence among the populations conerning what they perceive to already exist and what they feel ought to be. Recommendations are made later

in this chapter from these results and implications, plus recommendations dealing with the results and analysis of the attitude assessment portion of the surveying and attitude statements from the workshop feedback and on-site visitations.

1. This study generally supports a definite need for more effective teaching methods information and training for instructors of water pollution control personnel. This is directly supported by a portion of the quote,

> "...to provide an instructor development program for individuals responsible for and/ or conducting environment training or related activities...to provide, on request, instructors and/or training materials in support of the training program of other Federal, State and local agencies." (see pages 59-60 this study)

Further, the workshops were geared toward helping educators in the area of water pollution control to train the needed specialists. (see page 106 this study) Also from the compilation of visitation data it was shown that teaching training or experience was considered the least necessary hiring qualification, generally waived in favor or content knowledge. Finding and keeping a qualified staff of instructors was considered a difficult problem, with the most notable gap in the teaching methods knowledge or experience of the instructors. (see pages 118-119 this study)

2. The study additionally demonstrates that most university teacher education programs have made little, if any,

effort preparing instructors in the field of water pollution control training. Referring again to the workshop data it was remarked that some manufacturers sponsor week long or summer courses for instructors to improve teaching methods knowledge and experience, but most courses, especially university level, involve one to four years training time. Mainly it was noted that instructor training possibilities remain very limited. (see page 119 this study) In the review of the literature (page 48 this study) the Agency view notes that there are existing needs for highly trained professionals to educate an increasing number of environmental managers.

3. The study indicates interest in Agency materials and programs among educational institutions. The feedback collected during the workshops, from the participants, indicated strong interest in Agency materials and programs. The workshop participants additionally felt that the EPA should continue production of prototype instructional materials as well as to continue its development of a cataloging system for materials and program available. (see pages 109 and 111 this study) In the review of literature, it was noted that a large portion of workforce and general education by the NTOTC of the Agency is provided, distributed, or developed for other educational institutions and public dissemination. (see page 43 this study)

From on-site visitations, most interviewees cited the value of the free loan materials available to them from Cincinnati, and that expanded focus on IRIS seemed to have increased use of items from this system. (see page 113 this study)

4. As evidenced by this study accessibility and cost factors have been limiting obstacles for educational institutions involved with water pollution control training. Workshop participants cited the need to establish a clearing house to aid them in: obtaining information on new programs and materials; determining the availability of these programs and materials; checking evaluations and reviews of new programs and materials; how and where instructors can be trained to use such programs and materials; general functionality of trainees; and the longeivity of their graduates. (see pages 109 and 110 this study) Interviewees response to hypothetically being given the authority to control USEPA funds for training found the majority opinion was to spend the monies for direct training by expanding facilities as well as improving the existant facilities. They felt package monies could better be spend placed in "new" hands or more direct regional facility upgrading, including the purchase of mobile units for in the field training. (see page 115 this study) Almost without exception, the

educational training programs were not cost efficient, and had to receive support from various forms of outside funding. (see page 120 this study) Textbook costs tabulated in Appendices P, Q, R, and S show that students rated cost 'about right', instructors rated the cost 'too high' and program directors or deans rated costs in a three way split of'too high'-'about right'-'cheap'. From the review of literature it was noted that budgetary cuts and their resultant limitations on options for Agency achievement of training objectives have had significant impact, beginning in 1977. (see page 45 this study) Also in the review of the literature the lack of multi-discipline co-ordination of the Agency's offices has had the effect of preventing fund transfers to areas of greatest need or current priority. (see page 54 this study) Other cost complexities dealing with government fundings are detailed in the review of literature on page fifty-three, this study.

5. One specific result of the study indicates that video-tape cassettes are not presently feasible for training use due to a lack of playback equipment and difficulties of small screen viewing capability according to on-site conference information. (see page 114 this study) The workshop participants also cited video-tape cassettes of little utilitarian value at present because of a lack of playback equipment. (see page 111 this study) In surveying

the format type materials, video-tape cassettes were rated 'too high' for cost by thirty to forty-nine percent of all the survey respondants. (see page 102 and Appendix S this study) Additionally, a majority of the program directors or deans rated video-tape cassettes as 'not useable' for practicality. (see page 100 and Appendix R this study) A majority of all those surveyed rated video-tape cassettes 'seldom' for past useage. (see Appendix S this study) Low past useage rates in Appendices P, Q, and S for various format materials types in presentations is linked with the need for more effective teaching methods information and training for instructors of water pollution control personnel.

6. The study indicates the highest priority of concern relates to the strengthening of water pollution control training institutions and their programs through activities which will narrow the perceived differences of the four affected populations relevant to this field. The workshops were developed in order to improve the availability to meet the increased need for technicians, operators, and engineers with training in the area of water pollution control by strengthening water pollution control training centers at educational institutions across the country. (see pages 106 and 107 this study) In order to achieve the legislated mandates concerning pollution and attain the set goals of the Agency and this country there must be good, strong

training and education of personnel, and perhaps even the general public. To achieve good training there is the need for sound educational instituions that offer programs that meet the field needs as well as instructors who can use necessary teaching methods to allow students to benefit from their content knowledge and experience.

Recommendations

1. The institution of a mandatory national certification program for those in the field of water pollution control, adminstered by the NTOTC of the Agency is recommended. As substantiated in the analysis of the first part of the survey and supported by citations from workshop participants and on-site conference interciewees, there is a significant difference between what field-related employers feel the curriculum content of incoming employees should be and what trainers (instructors, program directors or deans) and students (future employees) feel they should have. This fact certainly does not lend itself to efficient, proper operation of water treatment facilities. The USEPA, the mandated agency dealing with the environment, most specifically the NTOTC of the Agency, it would seem would be a logical unit to take the lead in investigating and narrowing the differences in curriculum that exist. The Agency should establish generally what the curriculum

content should be and set minimum standards. This need can be paralleled to the field of aviation. In the early days of flying there were only a few individuals involved and there was no need for strict certification requirements. Flying and a large flight transportation industry have developed involving millions of people each year. The need for adequate training of pilots, flight attendants, and ground support personnel is now necessary. A national certifying agency, the FAA, has developed with corollated growth to match the expansion in the flight transportation industry. Basic minimum standards have been agreed to and are followed in granting certifications and licenses. To police the minimum standards of training and operation, the FAA constantly monitors and reviews individuals, companies, and the industry overall. Water treatment in its infancy did not require people with sophisticated training or facilities that require tens of thousands of well trained workers. (Middlebrooks,1972b) This field now requires a comprehensive national program. It is my belief, along with many others as shown in the surveying, workshop data, and interview information from the on-site conferences, that a mandatory national certification program should be instituted for those in the field of water pollution control similar to the certification that

has been developed for the aviation industry. This national certification program could be overseen and administered by NTOTC of the Agency. Historically, the Agency, NTOTC and its predecessors have been involved in this training. (see pages 43-45 this study; Sheehy, 1965) The U. S. Congress has mandated the USEPA to clean-up the waterways of this country. It is impossible to do this without an adequately trained workforce, and it seems then that the Agency not only has the need to do this, but the lawful obligation. Control of such a national certification program by the Agency for compliance and enforcement of minimums could be linked with USEPA control over grant funding in this field.

2. It is recommended that equal or proportionately matched funds for training be budgeted in construction grants. If the U. S. Congress actually intends to achieve the mandate of reaching the goal of clean waterways by the 1980's, then it must realize that increased monies must be budgeted for adequate training of the workforce to keep pace with the building grant funding that has already been underwritten. The billions of dollars the Agency has spent and has budgeted to spend for construction of facilities must be balanced by proportionately adequate budgeting to the NTOTC of the Agency for water pollution control training.

3. Establishment of a national instructor training center is recommended under the NTOTC of the Agency in conjunction with a major university or college of education. Looking at the second part of the survey, on-site conference data compilation, and workshop data, it became apparent that there are differences of feeling about the proper teaching skills used in the training programs. (see pages 90-91 this study) These feelings may stem from the fact that most training institution instructors are former operators or field-related employees. To make the assumption that because a person can operate a plant and has much content knowledge (assuming that he does) does not mean that such a person is adequately able to teach someone else plant operation or content knowledge. To make this assumption is to further a fallacy. It takes a great deal of training to acquire and demonstrate sound teaching skills. Colleges of education all across this country spend large volumes of money and four to five years training students to do just this. It would seems only logical that since water pollution control training must have quality instruction and that at present teaching skills acquired are questioned, that the NTOTC of the Agency as the authorized regulatory agency in this field should begin teaming up with colleges of education. This pariing should assure not only the proper

"what" (content) being taught, but the proper "how" (methods) for the information to be presented for learning in the best possible way. This can best be accomplished by thes steps. First, con inuing on a regularly scheduled basis instructor training workshops held in Cincinnati by the NTOTC with the assistance of a university college of education along with other national education figures. Second, the establishment of a national instructor training center at NTOTC of the Agency under the operation of or close association with a college of education in a major university for assemblance, distribution and cataloging of materials and training operations currently operating or available nationwide. This would properly operate as a national clearing house, the need for which has been substantiated in all three portions of data collection for this study. Third, the national instructors training center, on a regularly scheduled basis, would initiate and contract for training workshops to be held in each of the ten regions through the co-ordination of the regional offices of the Agency.

4. Continued production and dissemination of quality training materials by the Agency is also recommended. Varied types of materials are used in water pollution control training. There are many format types to be considered. The populations surveyed through representative units of analysis in this study indicated some very useful information

regarding these format materials types. The quality and accessability of the fifteen surveyed format materials types were questioned on a rating scale 'adequate'-'undecided'-'inadequate'. Neither quality or accessability was rated as 'adequate' by much more than a third of those responding. Past usage seems to be closely related to the above two categories, with most of the fifteen format materials types rated 'below average' for the past usage category. Two seemingly contradictory survey results are that the category cost of materials was generally rated 'about right' and that the category practicality of materials received an overwhelmingly 'useful' rating among the fifteen format materials types. Overcoming the problem of quality and accessibility of materials could be resolved through the previously mentioned national instructor training center and the existing IRC of the NTOTC under the Agency, which should be expanded to act as a clearing house for materials to be professionally evaluated, cataloged, and nationally disseminated. This would resolve the problem and promote increasing usage of programs and materials. The need for the mentioned services is clearly shown by the survey results, workshop feedback, and data compilation from on-site interviews. In all but two of the format type materials, results indicate clearly the need for materials

to definitely be produced.

5. It is recommended that the Agency promote a program for positive public exposure. To be effective in mandated tasks, an agency such as the USEPA needs an overall public attitude that is positive toward the agency. The attitude survey results indicate a nearly neutral composite attitude toward the Agency in this study, based on the Purdue Master Attitude Survey. While not a negative attitude, this is an indication that some good public relations work needs to be accomplished. The development and wide distribution of a newsletter as a source of communication by the NTOTC of the Agency to familiarize and continually update the educational community with Agency sponsored programs and courses could be achieved. Also as a communication link between training institutions a newsletter forms a good beginning. The advertisement and placement of articles in the trade journals would be additionally effective, as well as the use of other mass media for positive public exposure.

6. Encouraging elevation of education to the proper level of importance is the final recommendation. As yet education in this country seems generally a second hand consideration by many when it comes to solving problems. Billions of dollars are very quickly spent on buying, building and maintaining very expensive buildings and equipment, but when it comes to funding education and

training programs for staffing the use and operation of the equipment and buildings the dollars budgeted are much fewer and harder to obtain. This makes very little sense as education in this country has an outstanding record. Many knowledgeable people in fact attribute the longeivity of the American system of government to the establishment of compulsory free education for all.

The Federal government budgets billions of dollars each year to build very sophisticated buildings and equipment to achieve the mandated goal of clean waterways by the 1980's. Yet when these plants operate at less than desired efficiency and do not meet desired goals because of a lack of adequately trained workforce personnel, officials are perplexed. To solve part of this problem, the Agency should tie operator training funds as a corollary requisite for receiving construction grant funds. The educational operations of the NTOTC of the Agency should be greatly expanded and adequately funded on a more equally proportionate par with the research and development operations.

Hopefully it will be learned that education and training are at least as important as the material things and be elevated in priority considerations as well as funding concurrent with problem solving.

Comments on Areas for Further Study

Points worthy of additional study by future researchers in the field of water pollution control training include:

Further assessment on this same topic across the country due to the large numbers involved in the true populations of the four representative units of analysis in the survey section of this study to verify the findings of this study and extend them.

Regionally conducted assessments on this same topic which could involve more workforce and more time to the study than was available to this researcher to more fully document facts and directions for progress.

A study on the feasibility and possible funding avenues for increased water pollution control training programs across this country.

Studies by individual states on this same topic which could be more exhaustive than either nationwide or regionally conducted studies and could take advantage of more workforce and more time for further support of the need for water pollution control training.

A study of the optimum communication methods and source(s) for providing better communication among colleagues in the water pollution control training field, government institutions, and public interest groups.

A study or various studies of the functionality of trainees from water pollution control training programs with comparison to untrained personnel and determination of the degree of improved running of the treatment facility or facilities.

A study or studies of the longeivity of trainees from water pollution control training programs at various kinds of educational institutions in their job classifications.

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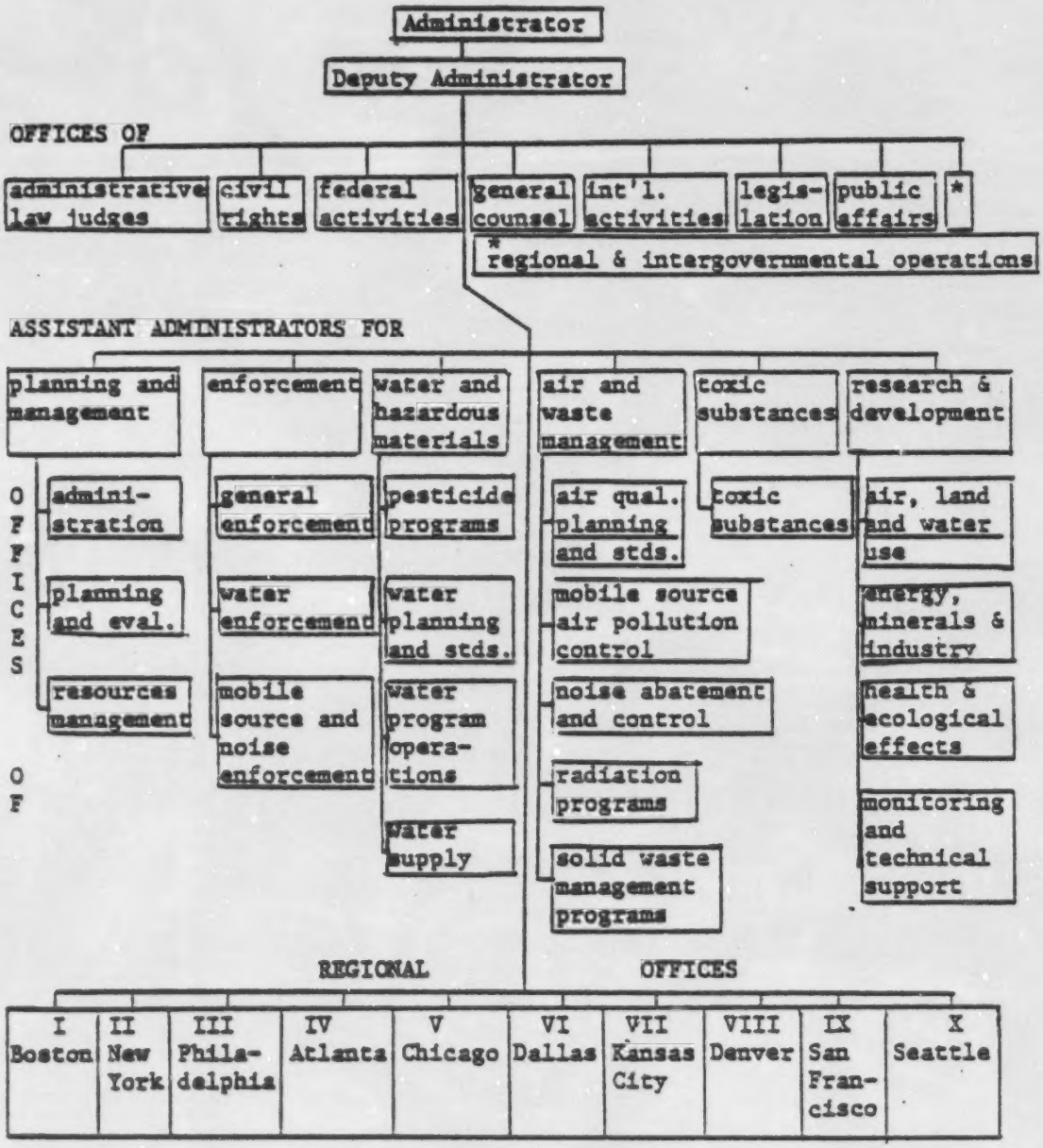
APPENDICES

APPENDIX A

Environmental Protection Agency

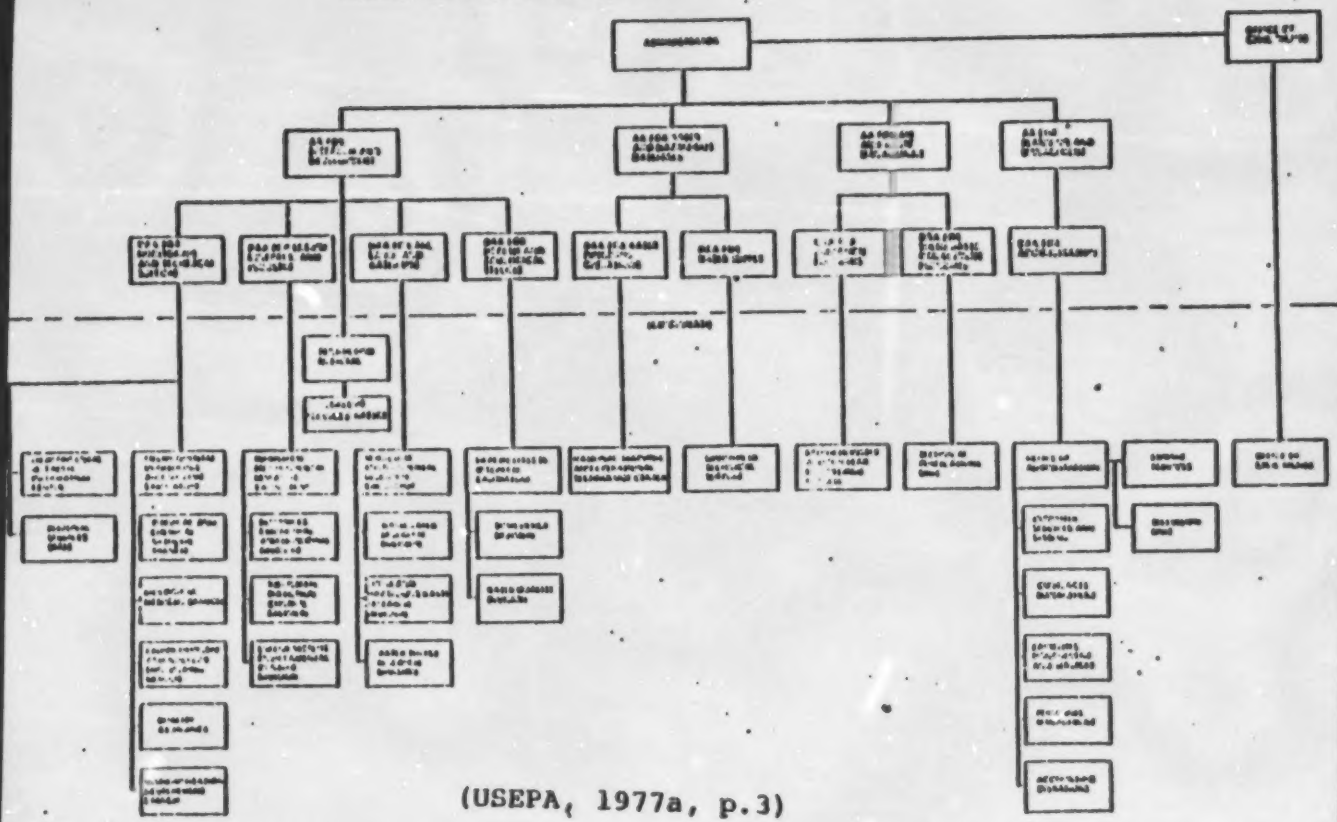


(USEPA, 1977i,p.2)

APPENDIX B

USEPA ENVIRONMENTAL RESEARCH CENTER CINCINNATI

Chain of Command Chart



(USEPA, 1977a, p.3)

APPENDIX C

COURSE OF INSTRUCTION
for representatives of
CONFERENCE OF STATE SANITARY ENGINEERS
March 14-26, 1932

FACULTY

U. S. PUBLIC HEALTH SERVICE

Office of Stream Pollution Investigations, Cincinnati, Ohio
- Sanitary Engineer J. K. Hoskins, in charge
- Sanitary Engineer H. W. Streeter
- Sanitary Engineer H. R. Crohurst
- Principal Bacteriologist C. T. Butterfield
- Principal Chemist E. J. Theriault
- Special Expert W. C. Purdy (Plankton Expert)
- Technical Assistant in Sanitary Engineering C. T. Wright
- Technical Assistant in Bacteriology Orena B. Stewart
- Junior Biochemist Elsie Wattie
- Technical Assistant in Chemistry Paul D. McNamee

Domestic Quarantine Division, Engineering Section, Washington
- Sanitary Engineer R. E. Tarbett, Chief of Section

Office of Malaria Investigations, Washington, D. C.
- Surgeon L. L. Williams, in charge

Office of Milk Investigations, Washington, D. C.
- Sanitary Engineer Leslie C. Frank, in charge

Office of Rural Sanitation, Washington, D. C.
- Special Supervising Engineer H. E. Miller

Conference of State Sanitary Engineers

E. S. Tisdale, Director, Division of Sanitation
West Virginia State Department of Health

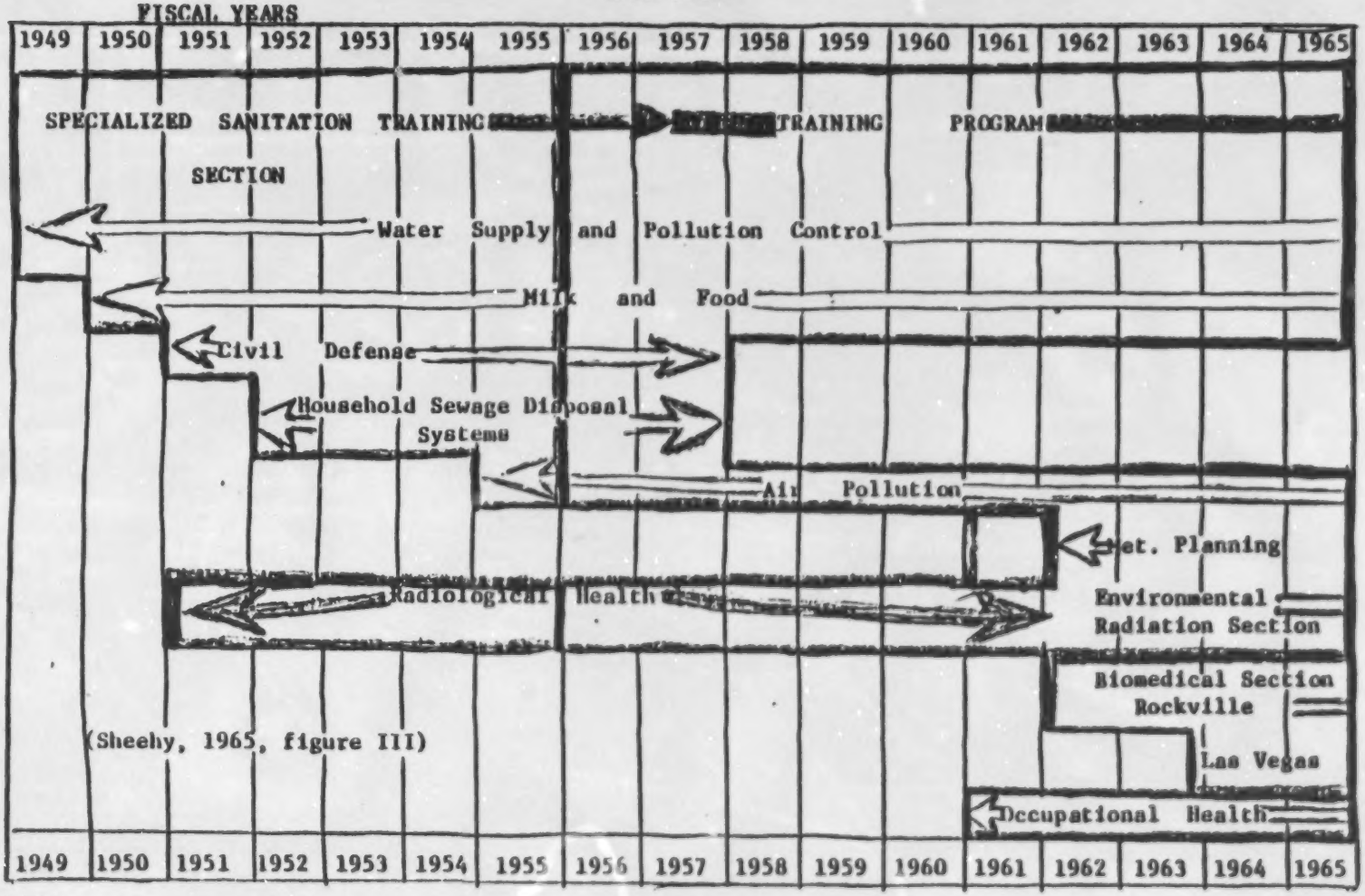
MEMBERS OF THE CLASS	State Representative	Title
Arizona	W. B. West	Assistant Bacteriologist
California	Frank E. DeMartini	Junior Sanitary Engineer
Connecticut	Caryl Carson	In Charge, Div. of Chemical Bureau of Laboratory
Idaho	L. J. Peterson	Bacteriologist

State	Representative	Title
Illinois	M. S. Sabin	Assistant Sanitary Engineer
Iowa	R. B. McAllister	Assistant Sanitary Engineer
Kansas	Charles C. Dills	Assistant Sanitary Engineer
Kentucky	F. C. Dugan	Director, Bureau of Sanitary Engineering
Massachusetts	William H. Doggett	Assistant Engineer
Minnesota	F. L. Woodward	Associate Sanitary Engineer
Missouri	L. O. Williams	District Engineer
New Hampshire	L. W. Trager	Assistant Sanitary Engineer
New York	A. S. Bedell	Assistant Sanitary Engineer
North Carolina	W. H. Booker	Director, Division Sanitary Engineering
Oklahoma	Taylor Rogers	State Chemist
Pennsylvania	F. E. Daniels	Chief, Industrial Waste Section
Rhode Island	R. M. Huey	Assistant Sanitary Engineer
South Carolina	William Weston	Assistant Sanitary Engineer
Texas	Chester Cohen	Assistant Engineer
West Virginia	L. K. Herndon	Chemical Engineer, State Water Commission
Wisconsin	O. J. Muegge	Assistant Sanitary Engineer

(Shaehy, 1965, AppendixI)

APPENDIX D

OPERATING TRAINING UNITS AND SECTIONS
1949-1965



(Sheehy, 1965, figure III)

APPENDIX E.

STUDENT UNIT OF ANALYSIS MAIL SURVEY

The following content areas are suggested as being of some importance in the area of Water Pollution Control Training.

In the columns on the left preceding each item place an X in the appropriate box indicating the amount of background you have in each area.

In the columns to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area.

1. Air Quality Management in Government and Industry.										
2. Design of Environmental Control Systems										
3. Environmental Chemistry										
4. Environmental Hydraulics										
5. Environmental Hydrology										
6. Environmental Microbiology										
7. Environmental Nutrition										
8. Environmental Ecology										
9. Ground Water Hydrology and Hydrogeology										
10. Hydraulic Design of Treatment and Pumping Facilities										
11. Hydraulic Engineering										
12. Open Channel Flow										
13. Urban Water Systems										
14. Small Portable Technology										
15. Solid Waste Analysis										
16. Solid Waste Disposal										
17. Water Pollution Effects										
18. Water Pollution and Environmental Law										
19. Watershed Hydrologies										
20. Agricultural Wastes and the Environmental Problems in Its Disposal										
21. Ecology										
22. Biological Effects of Water Pollutants										
23. Biological Indicators of Environmental Pollution										

The following content areas are suggested as being of some importance in the area of Water Pollution Control Training.

In the columns on the left preceding each item place an X in the appropriate box indicating the amount of background you have in each area.

In the columns to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area.

24. Biostatistics										
25. Carcinogenesis										
26. Cellular Anatomy										
27. Chemical and Biological Effects of the Marine Environment										
28. Design of Environmental Quality Monitoring Programs										
29. Energy and Environment										
30. Environmental Hygiene Technology										
31. Environmental Quality Management										
32. Epidemiology										
33. Epidemiology of Industrial Diseases										
34. Ergonomics - Study of Systems										
35. Health Physics										
36. Industrial Hygiene										
37. Industrial Safety										
38. Industrial Technology Practice										
39. Instrumental Methods of Analysis of Pollutants										
40. Studies for the Health Sciences										
41. Aerosols Transport and Distribution										
42. Mutagenesis										
43. Neurobehavioral Toxicology										
44. Occupational Dermatology										
45. Occupational Health										
46. Occupational Medicine										

The following content areas are suggested as being of some importance in the area of Water Pollution Control Training.

In the columns on the left preceding each item place an X in the appropriate box indicating the amount of background you have in each area.

In the columns to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area.

47. Physical Aspects of the Environment										
48. Physiology										
49. Pollution Ecology										
50. Principles of Cell Culture										
51. Radiation Health										
52. Survey Sampling										
53. Survival Analysis										
54. Theory and Applications of Systems Technology										
55. Virology										
56. Community Ecology										
57. Ecology and the Environment										
58. Environmental Stress										
59. Environmental Physiology										
60. Environmental Politics and Administration										
61. Human Adaptation										
62. Urban Ecology										
63. Microbial Ecology										
64. Natural Resources in World Politics										
65. Plant Ecology										
66. Population Dynamics										
67. Population Geography										
68. Urban Habitat										
69. Use of Data Processing and Computer Technology										

In teaching there are other aspects to be considered in addition to the content areas. These are identified as teaching skills. Rate each of the following skills as to the importance each holds in training.

	LEVEL OF TRAINING			IMPORTANCE		
1. Questioning techniques						
2. Using A-V materials						
3. Gaming						
4. Using simulations						
5. Behavioral objectives						
6. Planning lessons						
7. Alternative teaching methods, i.e., inquiry, concept teg., values						
8. Student motivation						
9. Humanistic approach to education						
10. Individualizing instruction						
11. Evaluation						
12. Instructional awareness						
13. Classroom management and discipline						
14. Field trips						
15. Curriculum development						

Varied types of materials are used in Water Pollution Control Training. There are many format types to be considered. The following is a list of some that are available. Respond to each item by placing an X in the appropriate box in each of the four criteria to be considered.

Format Types	QUALITY			ACCESSABILITY OF MATERIALS			COST			PAST USAGE			PRACTICALITY			SHOULD MATERIAL BE PRODUCED IN THIS AREA?		
	Adequate	Undecided	Inadequate	Adequate	Undecided	Inadequate	Too High	About Right	Cheap	Often	Average	Seldom	Useful	Undecided	Not Useable	Definitely	Undecided	Definitely Not
1. Student/instructor manuals																		
2. Video tape cassettes																		
3. Programmed and packaged courses of study																		
4. 16 mm films																		
5. Pamphlets																		
6. Newsletter																		
7. Textbooks																		
8. Slides																		
9. Tapes																		
10. Scripts																		
11. Games/simulations																		
12. Computer simulations																		
13. Workbooks																		
14. Specialized laboratory equipment																		
15. Lab guides																		

This Is A Standardized Survey Instrument.

Directions: Following is a list of statements about institutions. Place a plus sign (+) before each statement with which you agree about the institution or institutions listed at the left of the statements.

DOD - Department of Defense
USEPA - United States Environmental Protection Agency
OSHA - Occupational Safety and Health Administration
FDA - Food and Drug Administration
HEW - Department of Health, Education and Welfare

Institution	DOD	USEPA	OSHA	FDA	HEW
1. Develops good character.					
2. Is retained in the civilized world because of its value to mankind.					
3. Is increasing in its value to society.					
4. Is necessary as a means of controlling society.					
5. Is improving in its service to mankind.					
6. Is in the process of changing and will come out a fit instrument.					
7. Is not sufficiently appreciated by the general public.					
8. Its good and bad points balance each other.					
9. Has not yet proved itself indispensable to society.					
10. Is to conservative.					
11. Is too changeable in its policies.					
12. Is unfair to the individual.					
13. Is disgraced by its past.					
14. Is out of control of society and is running wild.					
15. Is an enemy of truth.					
16. Is the most despicable of institutions.					
17. Is the most hateful of institutions.					

This Is A Standardized Survey Instrument

Directions: Following is a list of statements about institutions. Place a plus sign (+) before each statement with which you agree about the institution or institutions listed at the left of the statements.

DOD - Department of Defense
USEPA - United States Environmental Protection Agency
OSHA - Occupational Safety and Health Administration
FDA - Food and Drug Administration
HEW - Department of Health, Education, and Welfare

Institution	DOD	USEPA	OSHA	FDA	HEW
1. Exerts a strong influence for good government and right living.					
2. Serves society as a whole well.					
3. Is necessary to society as organized.					
4. Adjusts itself to changing conditions.					
5. Is improving with the years.					
6. Does more good than harm.					
7. Will not harm anybody.					
8. Inspires no definite likes or dislikes.					
9. Is necessary only until a better one can be found.					
10. Is too liberal in its policies.					
11. Is losing ground as education advances.					
12. Promotes false beliefs and much wishful thinking.					
13. Does more harm than good.					
14. No one any longer has faith in this institution.					
15. Is detrimental to society and the individual.					
16. Benefits no one.					
17. Has positively no value.					

APPENDIX F.

INSTRUCTOR UNIT OF ANALYSIS MAIL SURVEY

The following content areas are suggested as being of some importance in the area of Water Pollution Control Training.

In the columns on the left preceding each item place an X in the appropriate box indicating the amount of background your students have in each area.

In the columns to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area.

1. Air Quality Management in Government and Industry.
2. Design of Environmental Control Systems
3. Environmental Chemistry
4. Environmental Hydraulics
5. Environmental Hydrology
6. Environmental Microbiology
7. Environmental Sanitation
8. Environmental Ecology
9. Ground Water Hydrology and Hydrogeology
10. Hydraulic Design of Treatment and Pumping Facilities
11. Hydraulic Engineering
12. Open Channel Flow
13. Urban Water Systems
14. Small Particle Technology
15. Solid Waste Analysis
16. Solid Waste Disposal
17. Water Pollution Effects
18. Water Pollution and Environmental Law
19. Watershed Hydraulics
20. Agricultural Waste and the Environmental Problems in its Disposal
21. Microbiology
22. Biological Effects of Water Pollutants
23. Biological Indicators of Environmental Pollution

The following content areas are suggested as being of some importance in the area of Water Pollution Control Training.

In the columns on the left preceding each item place an X in the appropriate box indicating the amount of background your students have in each area.

In the columns to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area.

24. Biostatistics
25. Geohydrologists
26. Cellular Biology
27. Chemical and Biological Effects of the Human Environment
28. Design of Environmental Quality Monitoring Program
29. Energy and Environment
30. Environmental Hygiene Technology
31. Environmental Quality Management
32. Epidemiology
33. Epidemiology of Infectious Diseases
34. Ergonomics - Study of Systems
35. Health Physics
36. Industrial Hygiene
37. Industrial Safety
38. Industrial Toxicology Practice
39. Instrumental Methods of Analysis of Pollutants
40. Statistics for the Health Sciences
41. Methane Transport and Distribution
42. Mutagenesis
43. Neurobehavioral Toxicology
44. Occupational Dermatology
45. Occupational Health
46. Occupational Medicine

The following content areas are suggested as being of some importance in the area of Water Pollution Control Training.

In the columns on the left preceding each item place an X in the appropriate box indicating the amount of background your students have in each area.

In the columns to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area.

	Very Strong	Strong	Not Strong	Limited	None
47. Physical Aspects of the Environment					
48. Physiology					
49. Pollution Meteorology					
50. Principles of Cell Culture					
51. Radiation Health					
52. Survey Sampling					
53. Survival Analysis					
54. Theory and Applications of Aerosol Technology					
55. Toxicology					
56. Community Ecology					
57. Ecology and the Environment					
58. Environmental Issues					
59. Environmental Physiology					
60. Environmental Politics and Administration					
61. Human Adaptation					
62. Urban Ecology					
63. Microbial Ecology					
64. National Resources in World Politics					
65. Plant Ecology					
66. Population Dynamics					
67. Population Geography					
68. Urban Habitat					
69. Use of Data Processing and Computer Technology					

In training there are other aspects to be considered in addition to the content areas. These are identified as teaching skills. Rate each of the following skills as to the importance each holds in training.

	LEVEL OF TRAINING			IMPORTANCE		
	Strong	Acceptable	Weak	Very	Moderated	Not
1. Questioning techniques						
2. Using A-V materials						
3. Gaming						
4. Using simulations						
5. Behavioral objectives						
6. Planning lessons						
7. Alternative teaching methods, i.e., inquiry, concept tchg., values						
8. Student motivation						
9. Humanistic approach to education						
10. Individualizing instruction						
11. Evaluation						
12. Non-verbal awareness						
13. Classroom management and discipline						
14. Field trips						
15. Curriculum development						

Varied types of materials are used in Water Pollution Control Training. There are many format types to be considered. The following is a list of some that are available. Respond to each item by placing an X in the appropriate box in each of the four criteria to be considered.

Format Types	QUALITY			ACCESSABILITY OF MATERIALS			COST			PAST USAGE			PRACTICALITY			SHOULD MATERIAL BE PRODUCED IN THIS AREA?		
	Adequate	Undecided	Inadequate	Adequate	Undecided	Inadequate	Too High	About Right	Cheap	Often	Average	Seldom	Useful	Undecided	Not useable	Definitely	Undecided	Definitely Not
1. Student/instructor manuals																		
2. Video tape cassettes																		
3. Programmed and packaged courses of study																		
4. 16 mm films																		
5. Pamphlets																		
6. Newsletter																		
7. Textbooks																		
8. Slides																		
9. Tapes																		
10. Scripts																		
11. Games/simulations																		
12. Computer simulations																		
13. Workbooks																		
14. Specialized laboratory equipment																		
15. Lab guides																		

This Is A Standardized Survey Instrument.

Directions: Following is a list of statements about institutions. Place a plus sign (+) before each statement with which you agree about the institution or institutions listed at the left of the statements.

DOD - Department of Defense
USEPA - United States Environmental Protection Agency
OSHA - Occupational Safety and Health Administration
FDA - Food and Drug Administration
HEW - Department of Health, Education and Welfare

Institution	DOD	USEPA	OSHA	FDA	HEW
1. Develops good character.					
2. Is retained in the civilized world because of its value to mankind.					
3. Is increasing in its value to society.					
4. Is necessary as a means of controlling society.					
5. Is improving in its service to mankind.					
6. Is in the process of changing and will come out a fit instrument.					
7. Is not sufficiently appreciated by the general public.					
8. Its good and bad points balance each other.					
9. Has not yet proved itself indispensable to society.					
10. Is to conservative.					
11. Is too changeable in its policies.					
12. Is unfair to the individual.					
13. Is disgraced by its past.					
14. Is out of control of society and is running wild.					
15. Is an enemy of truth.					
16. Is the most despicable of institutions.					
17. Is the most hateful of institutions.					

This Is A Standardized Survey Instrument

Directions: Following is a list of statements about institutions. Place a plus sign (+) before each statement with which you agree about the institution or institutions listed at the left of the statements.

DOD - Department of Defense
USEPA - United States Environmental Protection Agency
OSHA - Occupational Safety and Health Administration
FDA - Food and Drug Administration
HEW - Department of Health, Education, and Welfare

Institution	DOD	USEPA	OSHA	FDA	HEW
1. Exerts a strong influence for good government and right living.					
2. Serves society as a whole well.					
3. Is necessary to society as organized.					
4. Adjusts itself to changing conditions.					
5. Is improving with the years.					
6. Does more good than harm.					
7. Will not harm anybody.					
8. Inspires no definite likes or dislikes.					
9. Is necessary only until a better one can be found.					
10. Is too liberal in its policies.					
11. Is losing ground as education advances.					
12. Promotes false beliefs and much wishful thinking.					
13. Does more harm than good.					
14. No one any longer has faith in this institution.					
15. Is detrimental to society and the individual.					
16. Benefits no one.					
17. Has positively no value.					

APPENDIX G.

PROGRAM DIRECTORS OR DEANS UNIT OF ANALYSIS MAIL SURVEY

The following content areas are suggested as being of some importance in the area of Water Pollution Control Training.

In the columns on the left preceding each item place an X in the appropriate box indicating the amount of background your students have in each area.

In the columns to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area.

Very Strong	Strong	Not Strong	Limited	None

1. Air Quality Management in Government and Industry.
2. Design of Environmental Control Systems
3. Environmental Chemistry
4. Environmental Hydraulics
5. Environmental Hydrology
6. Environmental Microbiology
7. Environmental Sanitation
8. Environmental Virology
9. Ground Water Hydrology and Hydrogeology
10. Hydraulic Design of Treatment and Pumping Facilities
11. Hydraulic Engineering
12. Open Channel Flow
13. Urban Water Systems
14. Small Particle Technology
15. Solid Waste Analysis
16. Solid Waste Disposal
17. Water Pollution Effects
18. Water Pollution and Environmental Laws
19. Watershed Hydraulics
20. Agricultural Waste and the Environmental Problems in its Disposal
21. Bioassay
22. Biological Effects of Water Pollutants
23. Biological Indicators of Environmental Pollution

Very Strong	Strong	Not Strong	Limited	None

The following content areas are suggested as being of some importance in the area of Water Pollution Control Training.

In the columns on the left preceding each item place an X in the appropriate box indicating the amount of background your students have in each area.

In the columns to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area.

Very Strong	Strong	Not Strong	Limited	None

24. Biostatistics
25. Carcinogenesis
26. Cellular Anatomy
27. Chemical and Biological Effects of the Human Environment
28. Design of Environmental Quality Monitoring Programs
29. Energy and Environment
30. Environmental Hygiene Technology
31. Environmental Quality Management
32. Epidemiology
33. Epidemiology of Infectious Diseases
34. Ergonomics - Study of Systems
35. Health Physics
36. Industrial Hygiene
37. Industrial Safety
38. Industrial Toxicology Practice
39. Instrumental Methods of Analysis of Pollutants
40. Kinetics for the Health Sciences
41. Membrane Transport and Metabolism
42. Mutagenesis
43. Neurobehavioral Toxicology
44. Occupational Dermatology
45. Occupational Health
46. Occupational Medicine

Very Strong	Strong	Not Strong	Limited	None

The following content areas are suggested as being of some importance to the work of these Pollution Control Training.

In the column on the left preceding each item place an X in the appropriate box indicating the amount of background your students have in each area.

In the column to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area.

47. Physical Aspects of the Environment										
48. Physiology										
49. Pollution Meteorology										
50. Principles of Cell Culture										
51. Radiation Health										
52. Survey Sampling										
53. Survival Analysis										
54. Theory and Applications of Aerosol Technology										
55. Toxicology										
56. Community Ecology										
57. Geology and the Environment										
58. Environmental Issues										
59. Environmental Physiology										
60. Environmental Politics and Administration										
61. Human Adaptation										
62. Urban Ecology										
63. Microbial Ecology										
64. National Resources in World Politics										
65. Plant Ecology										
66. Population Dynamics										
67. Population Geography										
68. Urban Habitat										
69. Use of Data Processing and Computer Technology										

In training there are other aspects to be considered in addition to the content areas. These are identified as teaching skills. Rate each of the following skills as to the importance each holds in training.

	LEVEL OF TRAINING			IMPORTANCE		
1. Questioning techniques						
2. Using A-V materials						
3. Coaching						
4. Using simulations						
5. Behavioral objectives						
6. Planning lessons						
7. Alternative teaching methods, i.e., Inquiry, Concept teng., Versus						
8. Student motivation						
9. Humanistic approach to education						
10. Individualizing instruction						
11. Evaluation						
12. Non-verbal messages						
13. Classroom management and discipline						
14. Field trips						
15. Curriculum development						

Varied types of materials are used in Water Pollution Control Training. There are many format types to be considered. The following is a list of some that are available. Respond to each item by placing an X in the appropriate box in each of the four criteria to be considered.

Format Types	QUALITY			ACCESSABILITY OF MATERIALS			COST			PAST USAGE			PRACTICALITY			SHOULD MATERIAL BE PRODUCED IN THIS AREA?		
	Adequate	Undecided	Inadequate	Adequate	Undecided	Inadequate	Too High	About Right	Cheap	Often	Average	Seldom	Useful	Undecided	Not Useable	Definitely	Undecided	Definitely Not
1. Student/instructor manuals																		
2. Video tape cassettes																		
3. Programmed and packaged courses of study																		
4. 16 mm films																		
5. Pamphlets																		
6. Newsletter																		
7. Textbooks																		
8. Slides																		
9. Tapes																		
10. Scripts																		
11. Games/simulations																		
12. Computer simulations																		
13. Workbooks																		
14. Specialized laboratory equipment																		
15. Lab guides																		

This Is A Standardized Survey Instrument.

Directions: Following is a list of statements about institutions. Place a plus sign (+) before each statement with which you agree about the institution or institutions listed at the left of the statements.

DOD - Department of Defense
USEPA - United States Environmental Protection Agency
OSHA - Occupational Safety and Health Administration
FDA - Food and Drug Administration
HEW - Department of Health, Education and Welfare

Institution	DOD	USEPA	OSHA	FDA	HEW
1. Develops good character.					
2. Is retained in the civilized world because of its value to mankind.					
3. Is increasing in its value to society.					
4. Is necessary as a means of controlling society.					
5. Is improving in its service to mankind.					
6. Is in the process of changing and will come out a fit instrument.					
7. Is not sufficiently appreciated by the general public.					
8. Its good and bad points balance each other.					
9. Has not yet proved itself indispensable to society.					
10. Is to conservative.					
11. Is too changeable in its policies.					
12. Is unfair to the individual.					
13. Is disgraced by its past.					
14. Is out of control of society and is running wild.					
15. Is an enemy of truth.					
16. Is the most despicable of institutions.					
17. Is the most hateful of institutions.					

This Is A Standardized Survey Instrument

Directions: Following is a list of statements about institutions. Place a plus sign (+) before each statement with which you agree about the institution or institutions listed at the left of the statements.

DOD - Department of Defense
USEPA - United States Environmental Protection Agency
OSHA - Occupational Safety and Health Administration
FDA - Food and Drug Administration
HEW - Department of Health, Education, and Welfare

Institution	DOD	USEPA	OSHA	FDA	HEW
1. Exerts a strong influence for good government and right living.					
2. Serves society as a whole well.					
3. Is necessary to society as organized.					
4. Adjusts itself to changing conditions.					
5. Is improving with the years.					
6. Does more good than harm.					
7. Will not harm anybody.					
8. Inspires no definite likes or dislikes.					
9. Is necessary only until a better one can be found.					
10. Is too liberal in its policies.					
11. Is losing ground as education advances.					
12. Promotes false beliefs and much wishful thinking.					
13. Does more harm than good.					
14. No one any longer has faith in this institution.					
15. Is detrimental to society and the individual.					
16. Benefits no one.					
17. Has positively no value.					

APPENDIX H.

FIELD-RELATED EMPLOYERS UNIT OF ANALYSIS MAIL SURVEY

The following content areas are suggested as being of some importance in the area of Water Pollution Control Training.

In the column on the left preceding each item place an X in the appropriate box indicating the extent of background your learning employee have in each area.

In the column to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area.

1. Air Quality Management in Government and Industry.
2. Design of Environmental Control Systems
3. Environmental Chemistry
4. Environmental Hydraulics
5. Environmental Hydrology
6. Environmental Microbiology
7. Environmental Sanitation
8. Environmental Virology
9. Ground Water Hydrology and Hydrogeology
10. Hydraulic Design of Treatment and Pumping Facilities
11. Hydraulic Engineering
12. Open Channel Flow
13. Urban Water Systems
14. Small Facilities Technology
15. Solid Waste Analysis
16. Solid Waste Disposal
17. Water Pollution Effects
18. Water Pollution and Environmental Laws
19. Watershed Hydraulics
20. Agricultural Waste and the Environmental Problems in Its Disposal
21. Biology
22. Biological Effects of Water Pollutants
23. Biological Indicators of Environmental Pollution

The following content areas are suggested as being of some importance in the area of Water Pollution Control Training.

In the column on the left preceding each item place an X in the appropriate box indicating the extent of background your learning employee have in each area.

In the column to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area.

24. Biostatistics
25. Carcinogenesis
26. Cellular Anatomy
27. Chemical and Biological Effects of the Human Environment
28. Design of Environmental Quality Monitoring Programs
29. Energy and Environment
30. Environmental Hygiene Technology
31. Environmental Quality Management
32. Epidemiology
33. Epidemiology of Infectious Diseases
34. Epidemics - Study of Systems
35. Health Physics
36. Industrial Hygiene
37. Industrial Safety
38. Industrial Toxicology Practice
39. Instrumental Methods of Analysis of Pollutants
40. Statistics for the Health Sciences
41. Membrane Transport and Metabolism
42. Mutagenesis
43. Neurobehavioral Toxicology
44. Occupational Dermatology
45. Occupational Heat X
46. Occupational Medicine

The following content areas are suggested as being of some importance in the area of Water Pollution Control Training.

In the columns on the left preceding each item place an X in the appropriate box indicating the amount of background your training employee have in each area.

In the columns to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area.

					47. Physical Aspects of the Environment					
					48. Physiology					
					49. Pollution Meteorology					
					50. Principles of Cell Culture					
					51. Radiation Health					
					52. Survey Sampling					
					53. Survival Analysis					
					54. Theory and Applications of Aerosol Technology					
					55. Toxicology					
					56. Community Ecology					
					57. Ecology and the Environment					
					58. Environmental Issues					
					59. Environmental Physiology					
					60. Environmental Politics and Administration					
					61. Human Adaptation					
					62. Urban Ecology					
					63. Microbial Ecology					
					64. National Resources in World Politics					
					65. Plant Ecology					
					66. Population Dynamics					
					67. Population Geography					
					68. Urban Habitat					
					69. Use of Data Processing and Computer Technology					

This Is A Standardized Survey Instrument.

Directions: Following is a list of statements about institutions. Place a plus sign (+) before each statement with which you agree about the institution or institutions listed at the left of the statements.

DOD - Department of Defense
USEPA - United States Environmental Protection Agency
OSHA - Occupational Safety and Health Administration
FDA - Food and Drug Administration
HEW - Department of Health, Education and Welfare

Institution	DOD	USEPA	OSHA	FDA	HEW
1. Develops good character.					
2. Is retained in the civilized world because of its value to mankind.					
3. Is increasing in its value to society.					
4. Is necessary as a means of controlling society.					
5. Is improving in its service to mankind.					
6. Is in the process of changing and will come out a fit instrument.					
7. Is not sufficiently appreciated by the general public.					
8. Its good and bad points balance each other.					
9. Has not yet proved itself indispensable to society.					
10. Is to conservative.					
11. Is too changeable in its policies.					
12. Is unfair to the individual.					
13. Is disgraced by its past.					
14. Is out of control of society and is running wild.					
15. Is an enemy of truth.					
16. Is the most despicable of institutions.					
17. Is the most hateful of institutions.					

This Is A Standardized Survey Instrument

Directions: Following is a list of statements about institutions. Place a plus sign (+) before each statement with which you agree about the institution or institutions listed at the left of the statements.

DOD - Department of Defense
USEPA - United States Environmental Protection Agency
OSHA - Occupational Safety and Health Administration
FDA - Food and Drug Administration
HEW - Department of Health, Education, and Welfare

Institution	DOD	USEPA	OSHA	FDA	HEW
1. Exerts a strong influence for good government and right living.					
2. Serves society as a whole well.					
3. Is necessary to society as organized.					
4. Adjusts itself to changing conditions.					
5. Is improving with the years.					
6. Does more good than harm.					
7. Will not harm anybody.					
8. Inspires no definite likes or dislikes.					
9. Is necessary only until a better one can be found.					
10. Is too liberal in its policies.					
11. Is losing ground as education advances.					
12. Promotes false beliefs and much wishful thinking.					
13. Does more harm than good.					
14. No one any longer has faith in this institution.					
15. Is detrimental to society and the individual.					
16. Benefits no one.					
17. Has positively no value.					

APPENDIX I

WORKSHOP SURVEY QUESTIONS

1. EPA wants to be more effective in assisting you to conduct quality educational and training programs in the area of water quality. How can this Federal agency become more effective in assisting your institutions?

2. In the past, EPA has funded demonstration programs, curriculum guides, course outlines, and audio/visual support. Prioritize the interests of the institutions you represent. (b) How can the EPA continue to get feedback in order to keep priorities current and properly arranged?

3. EPA is considering various methods to more effectively communicate current Federal pollution control policies and regulations that might need to be considered by educational and training institutions. What are the current barriers that limit open dialogue between this Federal agency and educational institutions?

4. An ongoing communication program needs to be established with a variety of individuals involved with training and education. EPA would like to establish a mailing list and send out a bulletin or newsletter to help in this communication process? a. Who should be on the EPA mailing list? b. What kinds of information should be included in the newsletter that would be useful to educational institutions?

APPENDIX J

On-Site Oral Interview Questions

1. Was the overall information and experience derived from your workshop trip to Cincinnati worth the time, expense (even though only twenty percent of the entire cost), and effort beneficial enough to have warranted your attendance?

2. What degree of awareness concerning USEPA activities and involvement in this field from Cincinnati were you knowledgable about prior to the workshop?

3. Have you used materials from USEPA Cincinnati you knew about or became aware of at the workshop since your return? If yes, how much and to what degree?

4. Given a choice of audio-visual equipment materials, what format, in your opinion, best suits educational institutions? (i.e. 16 mm films, slide/tape units, video-cassettes or printed materials)

5. Regarding both content and production methods, what quality level do you think USEPA materials presently achieve?

6. Have you used IRIS, and what are your impressions of the system?

7. If it were your decision, how should or could the USEPA spend funds for training, given a minimum million dollar plus budget? Do you feel programmed instruction is the sole current direction needing development and funding?

8. What are your thoughts concerning the necessity for a National Certification Program (educational plan and model)? Should such a national certification program be general or specific? Does your institution have a set of standards comparable to this already?

9. What are the present certification requirements in your location? Are they city based, regional, or statewide? Are there differnt grades or levels of certification? What qualifications (experience, education, apprenticeship) are required to become certified or licensed? Are there any renewal requirements beyond the initial certification?

10. Do you think any lack of job desirability or stigma hinders the profession's progress?

11. How do students get on the job training (o.j.t.)? What costs are involved to become trained (tuition, room and board, books, time, additonal expenses)? How old is the average student? What salaries can entry level employees

APPENDIX J (Continued)

11. (continued) expect following training?

12. Is there follow-up assessment of student trainees in the employment area with comparison to those who have not been trained to evaluate the impact upon job performance and overall if plants are subsequently better run?

13. What qualifications are sought in prospective instructors? Is there any problem finding qualified instructors to hire? Are there any difficulties in retaining such instructors? Do instructors have specific qualifications which require improvement through training? Where is such training obtainable? Where should it be available? Who should supply this training for instructors?

14. What textbook materials are in use? Was there any difficulty locating or selecting appropriate materials? Are there specific areas of necessary training without printed reference material available for training use?

15. Who has the authority over curriculum? How and what input is sought to improve, revise or evaluate the curriculum? Does your curriculum include retraining? If yes, to what extent?

16. Is your program cost efficient?

17. Are there training areas in this field which future growth will require be incorporated into the curriculum (i.e. computer technology)?

18. To reduce or avert the national wastewater problem, are we generally correctly directed and is progress being made from your viewpoint?

19. What better direction or effort might more efficiently reduce the national wastewater problem?

20. Are there points of clarification or areas in the field which you care to make further comments about or discuss today?

APPENDIX K.

COVER LETTER FOR FOUR UNITS OF ANALYSIS SURVEYS

University of Cincinnati

Cincinnati, Ohio 45221

DEPARTMENT OF CURRICULUM & INSTRUCTION
895 TEACHERS COLLEGE – NO. 2

Please fill out the questionnaire as quickly as possible as timing is very important to this study.

The questionnaire is part of an assessment of educational needs in the field of water pollution control. The general purpose of the survey is to collect data which will be analyzed to define needs for water pollution control training in programs across this country. This study is being conducted under the sponsorship of the University of Cincinnati through the College of Education and Home Economics

The information obtained from this study will be used to help in the upgrading of water pollution control training.

You are being contacted as a representative from one of four populations actively involved in water pollution control or water pollution control training. The four populations are: water pollution control training instructors, program directors or deans, students, and field related employers. By taking a few minutes to complete the enclosed survey, you will be providing important information for analysis and evaluation in this project. Your participation is on a voluntary basis. Your cooperation in agreeing to participate is individually important to provide adequate data that can be shown to be valid for the four populations being sampled. Your responses will be totally confidential. A code for identification will be used for follow-up contacts. Never will any responses be individually identified.

A self-addressed, stamped envelope is enclosed to allow easier completion of the survey and quicker mail response. Any numbers shown on the survey form should be ignored; they are included only to assist the processing of your answers. For each item in the survey, please mark only one response that you consider to be the most appropriate. In advance of receiving your assistance, please be assured that your time and cooperation are valuable and greatly appreciated.

Thank you.

Fred D. Williams

APPENDIX L.

FOLLOW-UP LETTER FOR FOUR UNITS OF ANALYSIS SURVEYS

University of Cincinnati
Cincinnati, Ohio 45221

DEPARTMENT OF CURRICULUM & INSTRUCTION
646 TEACHERS COLLEGE – NO. 2

This letter is to remind you that we have not received your questionnaire reply. Your help in filling out the questionnaire and returing it as soon as possible will be very much appreciated. You can be assured that your responses will be totally confidential. Never will any responses be individually identified.

The results of this survey will be used to help in the upgrading of water pollution control training. The general purpose of the survey is to collect data which will be analyzed to define needs for water pollution control training in programs across this country.

Please take a few minutes to fill out the questionnaire. For your convenience, another questionnaire has been enclosed. A self-addressed, stamped envelope is also included. If you would please mark only one response that you consider to be the most appropriate for each item in the survey, it would be most helpful. In advance of receiving your assistance, let me also remind you that your time and cooperation are valuable and greatly appreciated.

If you have already filled out and mailed the questionnaire, please disregard this letter and again let me thank you for your time and cooperation.

Thank you.

Fred D. Williams

APPENDIX M

MAIL SURVEY FIGURES AND RETURN RATES

unit of analysis	number of surveys sent	net number of surveys sent	undeliv-erable	not returned	returned	return per-centage rate
students	800	780	20	244	536	68.7%
instructors	500	490	10	143	347	70.8%
program directors or deans	200	198	2	97	101	51.0%
field-related employers	1,500	1,447	53	474	973	67.2%
TOTALS	3,000	2,915	85	958	1,957	67.1%

APPENDIX N.

EXPLORATION SURVEY WITH COVER LETTER

University of Cincinnati

Cincinnati, Ohio 45221

DEPARTMENT OF CURRICULUM & INSTRUCTION
608 TEACHERS COLLEGE – NO. 2

June 27, 1978

Dear

Please take a few minutes to complete this survey evaluation. The survey is part of a study centering primarily in educational training needs assessment in the field of water pollution control. The information will be used for assisting in the upgrading of water pollution control training.

You are being contacted as a college level educator for expert guidance and rating in this exploratory survey to avoid significant omissions and to validate the more formal data instruments that are to be used in the controlled study portion of this project. By taking a few minutes to complete this survey, you will be providing important information for making improvements and revisions in the initial survey instruments.

This exploration survey is being distributed for two purposes. One purpose is to obtain opinions and ratings with regard to question construction, question content, and other format design and details. The other purpose is to search for additional factors to be included in the final survey.

Thank you,

Fred D. Williams

Fred D. Williams

University of Cincinnati

Cincinnati, Ohio 45221

DEPARTMENT OF CURRICULUM & INSTRUCTION
[illegible]

DRAFT OF SURVEY COVER-LETTER

To: (survey respondant)

Please fill out the questionnaire as quickly as possible as timing is very important to this study.

The questionnaire is part of an assessment of educational needs in the field of water pollution control. The general purpose of the survey is to collect data which will be analyzed to define needs for water pollution control training in programs across this country. This study is being conducted under the sponsorship of the University of Cincinnati through the College of Education and Home Economics

The information obtained from this study will be used to help in the upgrading of water pollution control training.

You are being contacted as a representative from one of four populations actively involved in water pollution control or water pollution control training. The four populations are: water pollution control training instructors, program directors or deans, students, and field related employers. By taking a few minutes to complete the enclosed survey, you will be providing important information for analysis and evaluation in this project. Your participation is on a voluntary basis. Your cooperation in agreeing to participate is individually important to provide adequate data that can be shown to be valid for the four populations being sampled. Your responses will be totally confidential. A code for identification will be used for follow-up contacts. Never will any responses be individually identified.

A self-addressed, stamped envelope is enclosed to allow easier completion of the survey and quicker mail response. Any numbers shown on the survey form should be ignored; they are included only to assist the processing of your answers. For each item in the survey, please mark only one response that you consider to be the most appropriate. In advance of receiving your assistance, please be assured that your time and cooperation are valuable and greatly appreciated.

Thank you.

The purpose of this study is:

1. to determine the ideal background of trainers in Water Pollution Control.

2. to identify necessary teaching skills of Water Pollution Control trainers.

3. to identify the most useful and efficient ways to supply teaching resources for the training of Water Pollution Control personnel.

Assess this survey instrument on the following pages. After completing this individual question analysis, assess the degree to which the survey instrument as a whole fulfills the above purpose.

The survey fulfills the purpose:

completely	mostly	partially	not at all

Place an X in the appropriate box

DRAFT OF SURVEY

The following areas are suggested as being of some importance in the area of Water Pollution Control Training. In the column on the left preceding each item place an X in the appropriate box indicating the amount of background you have in each area. (1) very strong, (2) strong, (3) not strong, (4) limited, (5) none.

In the column to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area for Water Pollution Control Training. (1) very strong, (2) strong, (3) not strong, (4) limited, (5) none.

1	2	3	4	5		1	2	3	4	5
					1. Air Pollution Control Methods.					
					2. Air Pollution Management in Government and Industry.					
					3. Design of Environmental Control Systems.					
					4. Environmental Chemistry					
					5. Environmental Hydraulics					
					6. Environmental Hydrology					
					7. Environmental Microbiology					
					8. Environmental Sanitation					
					9. Environmental Virology					
					10. Ground Water Hydrology					
					11. Hydraulic Design of Treatment and Pumping Facilities					
					12. Hydraulic Engineering					
					13. Open Channel Flow					
					14. Urban Water Systems					
					15. Small Particle Technology					
					16. Solid Waste Analysis					
					17. Solid Waste Disposal					
					18. Water Pollution Effects					
					19. Water Pollution and Environmental Laws					
					20. Watershed Hydraulics					
					21. Agricultural Waste and the Environmental Problems in its Disposal					
					22. Biology					
					23. Biological Effects of Water Pollutants					

Rate the following survey items by placing an X in the appropriate box following each item. Place the X in the box as being a strong item, an acceptable item, or a weak item. The space to the right is provided for additional comments.

If not assigned to the survey, only rate the items as being strong, acceptable, or weak.

	Strong	Acceptable	Weak	
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
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17.				
18.				
19.				
20.				
21.				
22.				
23.				

READ DIRECTIONS & RESPOND AT RIGHT

DRAFT OF SURVEY

The following areas are suggested as being of some importance in the area of Water Pollution Control Training. In the columns on the left, preceding each item place an X in the appropriate box indicating the amount of background you have in each area. (1) very strong, (2) strong, (3) not strong, (4) limited, (5) none. In the columns to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area for Water Pollution Control Training. (1) very strong, (2) strong, (3) not strong, (4) limited, (5) none.

1	2	3	4	5		1	2	3	4	5
					24. Biological Indicators of Environmental Pollution					
					25. Biostatistics					
					26. Carcinogenesis					
					27. Cellular Anatomy					
					28. Chemical and Biological Effects of the Human Environment					
					29. Design of Environmental Quality Monitoring Programs					
					30. Energy and Environment					
					31. Environmental Hygiene Technology					
					32. Environmental Quality Management					
					33. Epidemiology					
					34. Epidemiology of Infectious Diseases					
					35. Ergonomics					
					36. Fetal and Neonatal Physiology					
					37. Health Physics					
					38. Industrial Hygiene					
					39. Industrial Safety					
					40. Industrial Toxicology Practice					
					41. Instrumental Methods of Analysis of Pollutants					
					42. Kinetics for the Health Sciences					
					43. Membrane Transport and Metabolism					
					44. Mutagenesis					
					45. Neurobehavioral Toxicology					
					46. Neurophysiology					

READ DIRECTIONS AND RESPOND AT RIGHT

Rate the following survey items by placing an X in the appropriate box following each item. Place the X in the box as being a strong item, an acceptable item, or a weak item. The space to the right is provided for additional comments.

Do not respond to the survey, only rate the items as being strong, acceptable, or weak.

	Strong	Acceptable	Weak	
24.				
25.				
26.				
27.				
28.				
29.				
30.				
31.				
32.				
33.				
34.				
35.				
36.				
37.				
38.				
39.				
40.				
41.				
42.				
43.				
44.				
45.				
46.				

DRAFT OF SURVEY

The following areas are suggested as being of some importance in the area of Water Pollution Control Training. In the column on the left preceeding each item place an X in the appropriate box indicating the amount of background you have in each area.
(1) very strong, (2) strong, (3) not strong, (4) limited, (5) none. In the column to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area for Water Pollution Control Training.
(1) very strong, (2) strong, (3) not strong, (4) limited, (5) none.

1	2	3	4	5		1	2	3	4	5
					47. Occupational Dermatology					
					48. Occupational Health					
					49. Occupational Medicine					
					50. Pharmacology					
					51. Physical Aspects of the Environment					
					52. Physiology					
					53. Pollution Meteorology					
					54. Preparative Techniques for Electron Microscopy					
					55. Principles of Cell Culture					
					56. Radiation Health					
					57. Survey Sampling					
					58. Survival Analysis					
					59. Toxicologists					
					60. Theory and Applications of Aquatic Technology					
					61. Toxicology					
					62. Community Ecology					
					63. Ecology					
					64. Ecology and the Environment					
					65. Environmental Issues					
					66. Environmental Physiology					
					67. Environmental Politics and Administration					
					68. Human Adaptation					
					69. Human Ecology					

READ DIRECTIONS AND RESPOND AT RIGHT

Rate the following survey items by placing an X in the appropriate box following each item. Place the X in the box as being a strong item, an acceptable item, or a weak item. The space to the right is provided for additional comments.

Do not respond to the survey, only rate the items as being strong, acceptable, or weak.

	Strong	Acceptable	Weak	
47.				
48.				
49.				
50.				
51.				
52.				
53.				
54.				
55.				
56.				
57.				
58.				
59.				
60.				
61.				
62.				
63.				
64.				
65.				
66.				
67.				
68.				
69.				

DRAFT OF SURVEY

The following areas are suggested as being of some importance in the area of Water Pollution Control Training. In the columns on the left preceeding each item place an X in the appropriate box indicating the amount of background you have in each area. (1) very strong, (2) strong, (3) not strong, (4) limited, (5) none. In the columns to the right following each item place an X in the appropriate box indicating how much background you feel is adequate in each area for Water Pollution Control Training. (1) very strong, (2) strong, (3) not strong, (4) limited, (5) none.

1	2	3	4	5	
					70. Microbial Ecology
					71. National Resources in World Politics
					72. Plant Ecology
					73. Population Dynamics
					74. Population Geography
					75. Urban Habitat

1	2	3	4	5

Rate the following survey items by placing an X in the appropriate box following each item. Place the X in the box as being a strong item, an acceptable item, or a weak item. The space to the right is provided for additional comments.

Do not respond to the survey, only rate the items as being strong, acceptable, or weak.

	Strong	Acceptable	Weak	
70.				
71.				
72.				
73.				
74.				
75.				

READ DIRECTIONS AND RESPOND AT RIGHT

DRAFT OF SURVEY

In training there are other very important aspects to be considered in addition to the teaching categories. These are identified as teaching skills. Rate each of the following skills as to the amount of your training and the importance each holds in training.

	Level of Training: Strong	Acceptable	Weak	Importance: Very	Considerable	Not
1. Questioning techniques						
2. Using A-V materials						
3. Gaming						
4. Using simulations						
5. Behavioral objectives						
6. Planning lessons						
7. Use of alternative teaching methods						
8. Student motivation						
9. Humanistic approach to education						
10. Individualizing instruction						
11. Evaluation						
12. Non-verbal awareness						
13. Classroom management and discipline						
14. Field trips						

Rate the following survey items by placing an X in the appropriate box following each item. Place the X in the box as being a strong item, an acceptable item, or a weak item. The space to the right is provided for additional comments.

Do not respond to the survey, only rate the items as being strong, acceptable or weak.

	Strong	Acceptable	Weak	
1.				
2.				
3.				
4.				
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READ DIRECTIONS AND RESPOND AT RIGHT

DRAFT OF SURVEY

Varied types of materials are used in Water Pollution Control Training. There are many format types to be considered. The following is a list of some of them that are available. Respond to each item by placing an X in the appropriate box in each of the four criteria to be considered.

Format Types	QUALITY: Adequate	QUALITY: Questionable	QUALITY: Inadequate	ACCESSIBILITY: Adequate	ACCESSIBILITY: Questionable	ACCESSIBILITY: Inadequate	COST: Too High	COST: About Right	COST: Cheap	SHOULD MATERIAL BE PRODUCED IN THIS AREA? Definitely	SHOULD MATERIAL BE PRODUCED IN THIS AREA? Questionably	SHOULD MATERIAL BE PRODUCED IN THIS AREA? Definitely Not
1. Student/Instructor manuals												
2. Video tape cassettes												
3. Programmed and packaged courses of study												
4. 16 mm films												
5. Pamphlets												
6. Newsletter												
7. Textbooks												
8. Slides												
9. Tapes												
10. Scripts												
11. Games/simulations												
12. Computer simulations												
13. Workbooks												
14. Specialized laboratory equipment												
15. Lab guides												

Rate the following survey items by placing an X in the appropriate box following each item. Place the X in the box as being a strong item, an acceptable item, or a weak item. The space to the right is provided for additional comments.

Do not respond to the survey, only rate the items as being strong, acceptable, or weak.

	Strong	Acceptable	Weak	
1.				
2.				
3.				
4.				
5.				
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15.				

READ DIRECTIONS AND RESPOND AT RIGHT

APPENDIX O.

MANUAL

FOR

THE PURDUE MASTER ATTITUDE SCALES

by

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West Lafayette, Indiana

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THE PURDUE MASTER ATTITUDE SCALES

Each of these scales is available in two equivalent forms, A and B. The scales are separately available as follows. Scale to measure attitude toward:

1. Any School Subject
2. Any Vocation
3. Any Institution
4. Any Defined Group
5. Any Proposed Social Action
6. Any Practice
7. Any Home-Making Activity
8. Individual and Group Morale
9. The High School

The Rationale of the Scales

The scaling procedure for each of the scales is the psychophysical principle that equally often observed differences are equal, often referred to as the Thurstone attitude scaling technique. Thurstone conceived this psychophysical principle as applicable to the scaling of attitude statements relevant to specific attitudes. He and his associates as well as other researchers did much experimentation testing the overall hypothesis and demonstrated its validity with reference to many specific attitude objects.[1]

The unique advantage of the Purdue Master Attitude Scales is that a single scale can validly measure attitude toward any one of a large number of specific attitudes with a known, adequate degree of reliability. Since the experimental work required in the construction of a single scale requires perhaps something like 200 hours, this makes readily apparent the tremendous practical advantage of these scales over those designed for specific attitude objects. For example, a scale to measure attitude toward each of all the existing vocations is only theoretically, not practically feasible, since to do so would require several hundred years for a single competent experimenter. In the broader context of psychological test theory a quotation from Cattell[2] is relevant:

"Particularized validation is not only devoid of proper scientific interest but deceptive in its promise of practical economy . . . . . its absurdity is most cogently argued by the demands of practical economy and efficiency alone; for a specific test for every occupation and life situation is its logical and impossible conclusion." (pp. 549-550).

Recent developments in attitude measurement have certain theoretical advantages, at least for developing a science of psychology. Examples of such developments are the Guttman scaling technique[3] and its refinements as well as the Semantic Differential developed by Osgood and his associates[4] and the Q-technique of Stephenson.[5] The Purdue Master Attitude Scales have the practical advantage of being brief, convenient and with obvious face and content validity for many purposes in their applicability to measurement and evaluation of attitudes.

Validity

Beyond their face validity, these scales have demonstrated validity both against Thurstone's specific scales with which they show typically almost perfect correlations and in differentiating among attitudes known to differ among various groups. Examples of such validation are: (a) attitude toward Sunday observance of Seventh-day Adventists vs. other church members. (Kelley, Ida B., "The Construction and Evaluation of a Scale to Measure Attitude Toward Any Institution." Bulletin of Purdue University, Studies in Attitudes, December 1934, pp. 18-36.); liking for social studies vs. science studies among high school students. (Silance, Ella Belle and Remmers, H. H. "An Experimental Generalized Master Scale: A Scale to Measure Attitude Toward Any School Subject." op. cit., pp. 84-87.); preference for the ministry vs.

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1. For detailed discussion of the experimental procedures in constructing such scales see Remmers, H. H. Introduction to Opinion and Attitude Measurement, New York: Harper & Bros., 1954, p. 87-94.

2. Cattell, R. B. Description and Measurement in Personality, Yonkers-on-Hudson: World Book Company, 1946.

3. For references to several of Guttman's papers see Remmers, op. cit., p. 135.

4. Osgood, C. E. et al. The Measurement of Meaning, Urbana, Illinois: the University of Illinois Press, 1958.

5. Stephenson, William. The Study of Behavior, Chicago: University of Chicago Press, 1953.

engineering (Remmers, H. H. "Measuring Attitudes Toward Vocations," op. cit., pp. 77-83.); attitudes toward drinking and petting among the members of social fraternities, sororities, Y.W.C.A. members and Sunday school members (Buss, H. W. "The Construction and Validation of a Scale to Measure Attitude Toward Any Practice," op. cit., pp. 64-67.); attitudes toward Negroes, Chinese, Whites, Egyptians, Syrians, English, and Jews (Grice, H. H. "The Construction and Validation of a Generalized Scale Designed to Measure Attitudes Toward Defined Groups." op. cit., pp. 37-46.); attitude toward any home-making activity (Kellar, Beatrix, "The Construction and Validation of a Scale for Measuring Attitude Toward Any Home-Making Activity." op. cit., pp. 47-63.). These are only a few samples of experimental studies carried out to construct and validate these scales. The interested reader will find further reports of experimental work in the monograph cited above and in the following references:

1. Bateman, R. M. and Remmers, H. H. "A Study of the Shifting Attitude of High School Students when Subjected to Favorable and Unfavorable Propaganda," Journal of Social Psychology, 1941, 13, 394-406.

2. Bateman, R. M. and Remmers, H. H. "Attitudes of High School Freshmen Toward Occupations of Their Choice Before and After Studying the Occupations by Means of a Career Book," Journal of Educational Psychology, December 1939, 657-666.

3. Remmers, H. H. "Attitudes Toward Germans, Japanese, Jews, and Nazis as Affected by the War," School and Society, January 30, 1943, V. 57, No. 1466, 138-140.

4. _____(Ed.) Studies in Attitudes: A Contribution to Social-Psychological Research Methods, Bulletin of Purdue University, December, 1934, 1-112.

5. _____"Changes in Attitudes Toward Germans, Japanese, Jews, and Nazis, as Affected by the War," School and Society, February 16, 1946, V. 63, No. 1625, 118-119.

6. _____"Changes in Attitude Toward Germans, Japanese, Jews, and Nazis," School and Society, June 28, 1947, V. 65, No. 1696, 484-487.

7. _____(Ed.) Further Studies in Attitudes Series II. Bulletin of Purdue University, December 1936, 1-298.

8. _____ Further Studies in Attitudes Series III. Bulletin of Purdue University, 1938, 1-151.

9. _____"Propaganda in the Schools- Do the Effects Last?" The Public Opinion Quarterly, April 1938, V. 2, No. 2, 197-210.

10. Tschechelin, Sister M. A., and Remmers, H. H. "Measuring the Attitudes of Elementary School Children Toward Their Teachers," The Journal of Educational Psychology, March 1940, 195-203.

11. Whisler, Laurence D., and Remmers, H. H. "The Effect of the Election on High School Pupils' Attitudes Toward the Two Major Parties," School and Society, April 17, 1937, V. 45, No. 1164, 558-560.

12. _____"A Scale for Measuring Individual and Group Morale," The Journal of Psychology, 1937, 4, 161-165.

13. _____"Liberalism, Optimism, and Group Morale: A Study of Student Attitudes," The Journal of Social Psychology, 1938, V. 9, 451-467.

14. Williamson, A. C., and Remmers, H. H. "Persistence of Attitudes Concerning Conservation Issues," The Journal of Experimental Education, March 1940, 354-361.

15. Wood, W. F., and Remmers, H. H. "Changes in Attitude Toward Germans, Japanese, Jews, and Nazis," School and Society, June 28, 1947, V. 65, No. 1696, 484-487.

Reliability

The original scales usually contained more than 40 items per form. Hancock's experimental study[6], demonstrated that a smaller number of items chosen to include the total range of scale values does not appreciable lower the reliability of the instrument as compared with the full-length scale. Accordingly, the present scales have all been reduced to 17 items per form.

The reliabilities of the original full-length scales for various population samples ranged from .71 to .92. These coefficients are, of course, functions of at least the following variables.

1. The "range of talent," i.e., the variability of the attitude in the population under study.
2. The extent to which the attitude in question is crystallized in the population.
3. The number of individuals in the sample.

For group studies - the usual use of these scales - the reliabilities of means will generally be quite adequate.

Scoring

The median scale value of the statements endorsed is the attitude score. If an odd number of statements is endorsed, the scale value of the middle item of those endorsed gives the score. For example, if three items are endorsed, say, for example, items Nos. 2, 3, and 5, the score is the scale value of item No. 3, i.e., 9.2, a highly favorable attitude.

If an even number of items is endorsed, say, for example, items Nos. 1, 2, 3, and 4, the score will be halfway between the scale values for items Nos. 2 and 3 i.e., 9.4. The indifference point on all scales is 6.0. Scores above 6.0 indicate a favorable attitude, scores below 6.0, an unfavorable attitude.

This method of scoring, much more rapid and convenient than Thurstone's method (averaging the scale values of the items endorsed) was extensively validated by Sigerfoos.[7]

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6. Hancock, J. W. "An Experimental Study of Limiting Response on Attitude Scales." Bulletin of Purdue University. Further Studies in Attitudes Series III. 1938. 142-151.

7. Sigerfoos, C. C. "The Validation and Application of a Scale of Attitude Toward Any Vocation." Bulletin of Purdue University. Further Studies in Attitudes, Series II. 1936. 177-191.

Note that these scales require no norms beyond the scale values that follow. The norms are, so to speak, "built in," since what is being measured is the affective value of an attitude object defined by the scale values of the items endorsed by respondents.

Scale Values for Forms A and B

Item	Scale Value	Item	Scale Value	Item	Scale Value	Item	Scale Value
1.	10.3	5.	8.5	9.	6.0	13.	3.1
2.	9.6	6.	8.1	10.	5.5	14.	2.6
3.	9.2	7.	7.7	11.	4.7	15.	2.2
4.	8.9	8.	6.5	12.	3.6	16.	1.6
						17.	1.0

APPENDIX P.

FREQUENCY TABLES FOR FORMAT MATERIALS TYPES STUDENTS

X = 50% or greater response / = 30% to 49% response

Format Types	QUALITY			ACCESSABILITY OF MATERIALS			COST			PAST USAGE			PRACTICALITY			SHOULD MATERIAL BE PRODUCED IN THIS AREA?		
	Adequate	Undecided	Inadequate	Adequate	Undecided	Inadequate	Too High	About Right	Cheap	Often	Average	Seldom	Useful	Undecided	Not useable	Definitely	Undecided	Definitely Not
1. Student/instructor manuals	X			X				X			X		X			X		
2. Video tape cassettes		X		/	/	/		X				X	/	/		X		
3. Programmed and packaged courses of study	X			/	/			X			X		X			X		
4. 16 mm films	/	/		X				X			X		X			X		
5. Pamphlets	X			X				X			X		X			X		
6. Newsletter		X		/	/			X			/	/	X			X		
7. Textbooks	X			X				X		/	/		X			X		
8. Slides	X			/	/			X			X		X			X		
9. Tapes		/	/		X			X				X	X			/	/	
10. Scripts		X			X			X				X		X			X	
11. Games/simulations	/	/			/	/		X				X	X			X		
12. Computer simulations		/	/		/	/		X				X	/	/			X	
13. Workbooks	X			X				X			X		X			X		
14. Specialized laboratory equipment	X			/		/	X					X	X			X		
15. Lab guides	X			X				X		X			X			X		

APPENDIX Q.

FREQUENCY TABLES FOR FORMAT MATERIALS TYPES INSTRUCTORS

X = 50% or greater response / = 30% to 49% response

Format Types	QUALITY			ACCESSABILITY OF MATERIALS			COST			FAST USAGE			PRACTICALITY			SHOULD MATERIAL BE PRODUCED IN THIS AREA?		
	Adequate	Undecided	Inadequate	Adequate	Undecided	Inadequate	Too High	About Right	Cheap	Often	Average	Seldom	Useful	Undecided	Not usable	Definitely	Undecided	Definitely Not
1. Student/instructor manuals	X			X				X		X			X			X		
2. Video tape cassettes		X				X	X					X		X		X		
3. Programmed and packaged courses of study		X		/	/	/		X				X	X			X		
4. 16 mm films		X			/	/	X				X		X			X		
5. Pamphlets		X			X		X				X			X		X		
6. Newsletter	/	/		X					X			X		X		X		
7. Textbooks	/	/		X			X			X			X			X		
8. Slides		X		/	/			X				X	X			X		
9. Tapes		X			X			X				X		X			X	
10. Scripts		X				X		X				X		X			X	
11. Games/simulations		X				X		X				X	/	/			X	
12. Computer simulations		X				X		X				X	X			X		
13. Workbooks	/	/		/		/		X			X		X			X		
14. Specialized laboratory equipment	X			X			X			X			X			X		
15. Lab guides	/	/		X				X			X		X			X		

APPENDIX R

FREQUENCY TABLE FOR FORMAT MATERIALS TYPES PROGRAM DIRECTORS OR DEANS

X = 50% or greater response / = 30% to 49% response

Format Types	QUALITY			ACCESSABILITY OF MATERIALS			COST			PAST USAGE			PRACTICALITY			SHOULD MATERIAL BE PRODUCED IN THIS AREA?		
	Adequate	Undecided	Inadequate	Adequate	Undecided	Inadequate	Too High	About Right	Cheap	Often	Average	Seldom	Useful	Undecided	Not usable	Definitely	Undecided	Definitely Not
1. Student/instructor manuals	X			X				X		X			X			X		
2. Video tape cassettes	/	/		X				X			X				X	X		
3. Programmed and packaged courses of study	/	/		/		/		X			X			X		/	/	
4. 16 mm films		X			X			X			X			X		X		
5. Pamphlets	X			X					X	/	/				X		X	
6. Newsletter		X		X			X				/	/		X			X	
7. Textbooks	X					X	/	/	/	X			/	/		X		
8. Slides	X			X			/	/	/	X			X				X	
9. Tapes	X			X				X		X			X			X		
10. Scripts	X				X			X		X				X			X	
11. Games/simulations	X				X			X		X				X		X		
12. Computer simulations		X				X	X					X		X		X		
13. Workbooks	X			X			/	/		X			X			X		
14. Specialized laboratory equipment	X				X		/	/			X		X			X		
15. Lab guides		X			X			X			X		X			X		

APPENDIX S.

FREQUENCY TABLES FOR FORMAT MATERIALS TYPES IN TOTAL

X = 50% or greater response / = 30% to 49% response

Format Types	QUALITY			ACCESSABILITY OF MATERIALS			COST			PAST USAGE			PRACTICALITY			SHOULD MATERIAL BE PRODUCED IN THIS AREA?		
	Adequate	Undecided	Inadequate	Adequate	Undecided	Inadequate	Too High	About Right	Cheap	Often	Average	Seldom	Useful	Undecided	Not useable	Definitely	Undecided	Definitely Not
1. Student/instructor manuals	X			X				X		/	/		X			X		
2. Video tape cassettes		X			/	/	/	/				X	/	/		X		
3. Programmed and packaged courses of study	/	/		/	/	/		X			/	/	X			X		
4. 16 mm films	/	/		/	/	/	/	/			/	/	X			X		
5. Pamphlets	/	/		/	/			X		/	/		/	/		X		
6. Newsletter	/	/		/	/			/	/		/	/	/	/		/	/	
7. Textbooks	X			X			/	/		/	/		X			X		
8. Slides	/	/		/	/	/		X		/	/		X			X		
9. Tapes		X			/	/		X				X	X			X		
10. Scripts		X			X			X				X		X			X	
11. Games/simulations	/	/	/		/	/		X				X	/	/		/	/	
12. Computer simulations		X				X	/	/				X	/	/			X	
13. Workbooks	/	/		X				X			X		X			X		
14. Specialized laboratory equipment	X			X			X			/	/	/	X			X		
15. Lab guides	X			X				X		X			X			X		